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YUKON RIVER ANADROMOUS FISH INVESTIGATIONS

TECHNICAL REPORT
July 1, 1975 to June 30, 1976

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Yukon River King and Chum Salmon Escapement Studies

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ABSTRACT

Yukon commercial fishing effort, best measured in terms of registered fishing vessels, has increased 103% since 1965 (487 vessels in 1965, 988 vessels in 1975). The gross value of the Yukon fishery to the fishermen increased 231% from 1965 to 1975.

The 1975 commercial Yukon River king salmon catch of 65,520 salmon was the smallest since statehood. The average king commercial catch for the previous 14 years was 101,379.

The total observed escapement for Alaskan king salmon in 1975 was 4,596 and 2,109 for Canadian king salmon which is considered to be only fair for the Alaska portion of the escapement. Aerial enumeration in Alaska was more comprehensive than in past years. The 1975 king escapement for the Anvik River was estimated at 730.

Salmon migration into the main River and spawning streams was apparently affected by low water temperatures and was generally very late during 1975. King salmon upstream movement past the Anvik tower did not peak until July 27; peak king salmon Anvik tower counts were made on July 19th and July 10th for 1973 and 1974, respectively.

Preliminary figures on the summer and fall chum salmon commercial harvest for Alaska and Canada show 987,360 fish landed. Commercial catches for this species averaged 257,000 annually during 1960-1975. Record commercial chum catches for 1974 and 1975 reflect very high run levels and increased commercial effort.

Escapement documentation of the major Yukon chum salmon spawning streams was poor prior to 1970. The 1975 chum salmon observed escapement of 2,151,880 was the highest documented escapement for the Yukon system. The total run index for 1975 (commercial catch, subsistence catch, observed escapement) was a record high 3,418,160 fish. Annual documented chum escapements and total run indices since 1971 have averaged 704,020 and 1,520,700 respectively.

The 1975 expanded escapement of summer chums past the Anvik tower was 601,868, an all-time record. The Anvik, Andreafsky (West Fork), Nulato, Gisasa and Rodo Rivers, all recorded historically high observed escapements in 1975.

Escapement enumeration of chum salmon at the Fishing Branch weir in Canada was an all-time high of 353,300 fish. The Sheenjek and Toklat

Rivers in Alaska had similar record levels of escapement during 1975-78,000 chums each. These three streams accounted for 90% of all fall chum escapement for the years 1974 and 1975.

For the Yukon as a whole, 87.9% of 4,261 chum salmon aged during 1975 were 4_1's. Age class 3_1 represented 6.9% and age class 5_1 represented 5.2% of the escapement samples.

A total of 10,730 coho were observed on the spawning grounds in 1975.

A Yukon record escapement of 50,960 pink salmon was observed during aerial surveys of the Andreafsky stream in July of 1975.

INTRODUCTION

Description of Yukon River

The Yukon River, the largest river in Alaska, originates in British Columbia within 30 miles of the Gulf of Alaska to flow over 2,300 miles before emptying into the Bering Sea, draining an area of approximately 330,000 square miles (Figure 1). The Yukon area includes all waters of the Yukon River drainage in Alaska and all waters from Canal Point light southward to Cape Romanzof.

Commercial salmon fishing is allowed along 1,400 river miles. As indicated in Figures 2 through 4, the Alaskan portion of the drainage is divided into six statistical areas for fishery management and regulatory purposes. The major commercial fisheries are found in the lower 150 miles. Limited commercial fishing is widely dispersed over 900 river miles of the upper Yukon and lower Tanana Rivers. Tributary streams of the Yukon and Tanana Rivers are closed to commercial fishing.

Many people in the Yukon area are dependent to varying degrees on the fish and game resources for their livelihood. Subsistence fishermen operate gill nets in the main rivers and to a lesser extent in the coastal marine waters to capture mainly salmon, whitefish and sheefish. Fish-wheels take considerable numbers of salmon in the Yukon River. Beach seines are occasionally used near the spawning grounds to catch schooling or spawning salmon.

All five species of eastern Pacific salmon are indigenous to the River with chum salmon being the most abundant. King salmon rank second in abundance followed in order by coho, pink and sockeye salmon. It is believed that the Yukon River is the greatest single king and chum salmon producing system in Alaska. Pink and coho are found in lesser numbers and there is no major fishery for them. Sockeye salmon are extremely rare and only a few fish are taken annually.

Yukon River chum salmon are composed of distinct summer and fall stocks. The more abundant summer chums are distinguished in part by: earlier upstream migration and spawning; utilization of lower Yukon drainage spawning areas; generally smaller body size; and the earlier appearance of spawning coloration. Fall chums are distinguished by: later migration and spawning; utilization of the upper Yukon River spawning areas; a generally larger body size; and lack of spawning colors (water marks) in the lower Yukon.

FIGURE 1. Yukon River map.

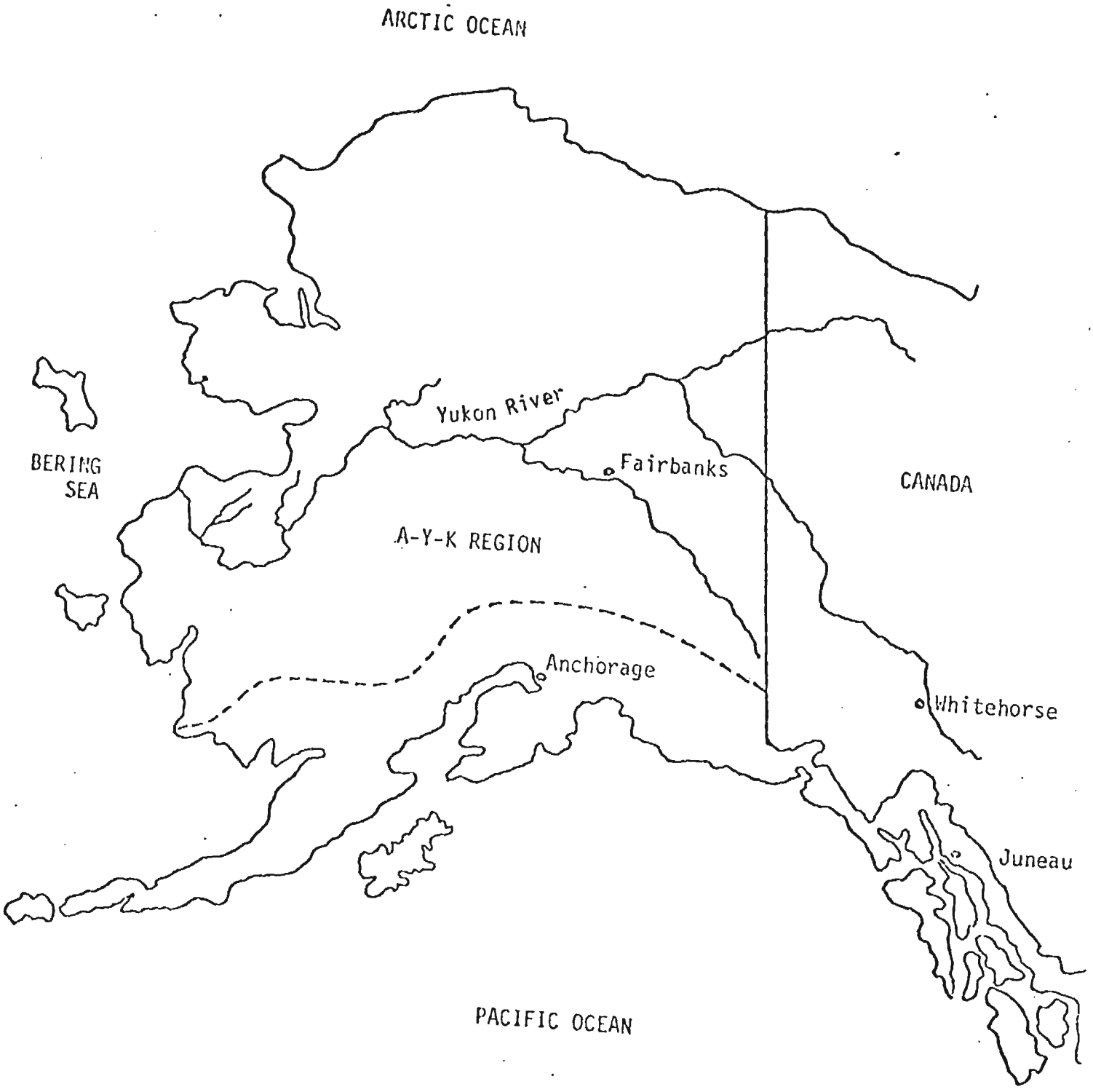


FIGURE 2. Lower Yukon River map.

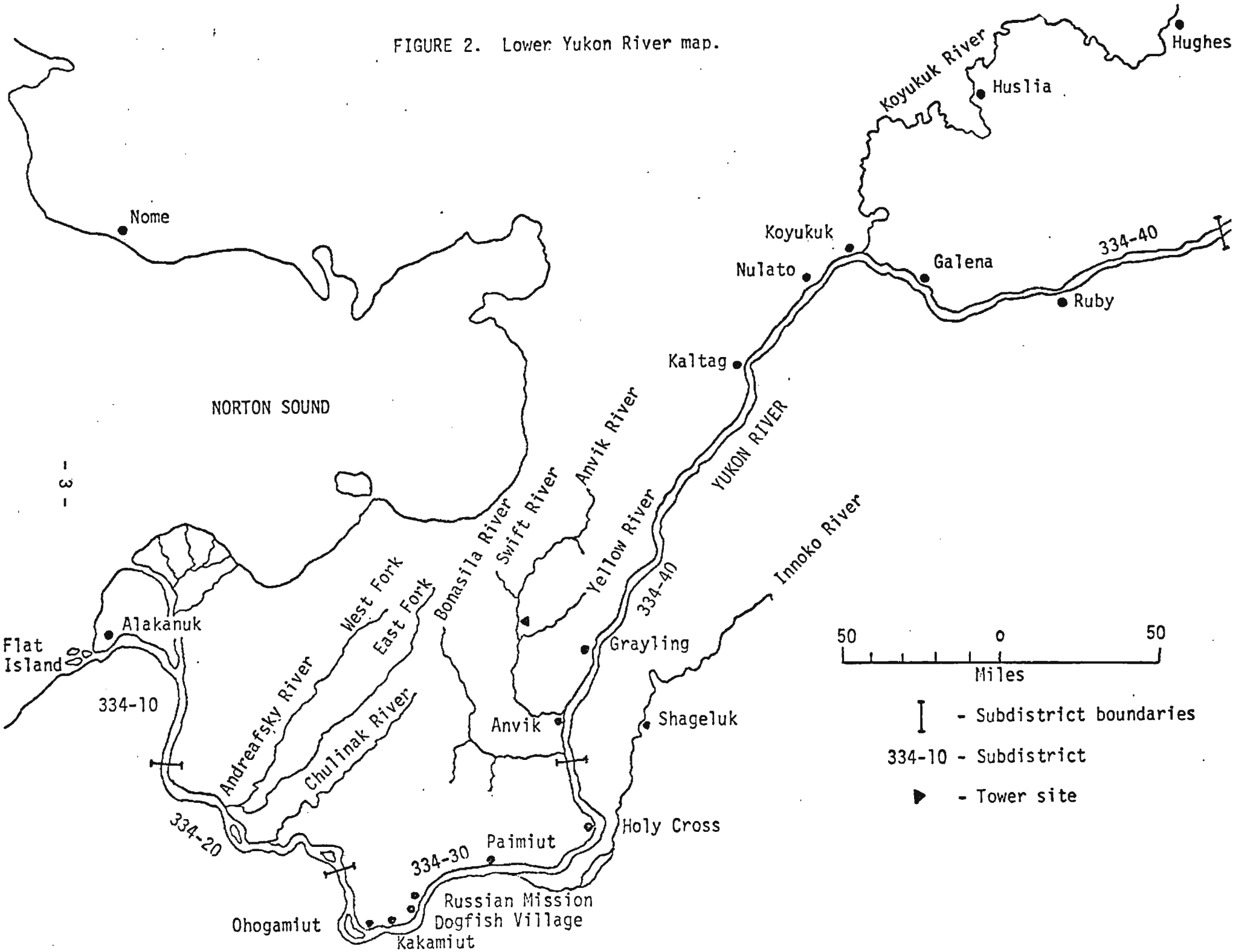


FIGURE 3. Mid-Yukon River map

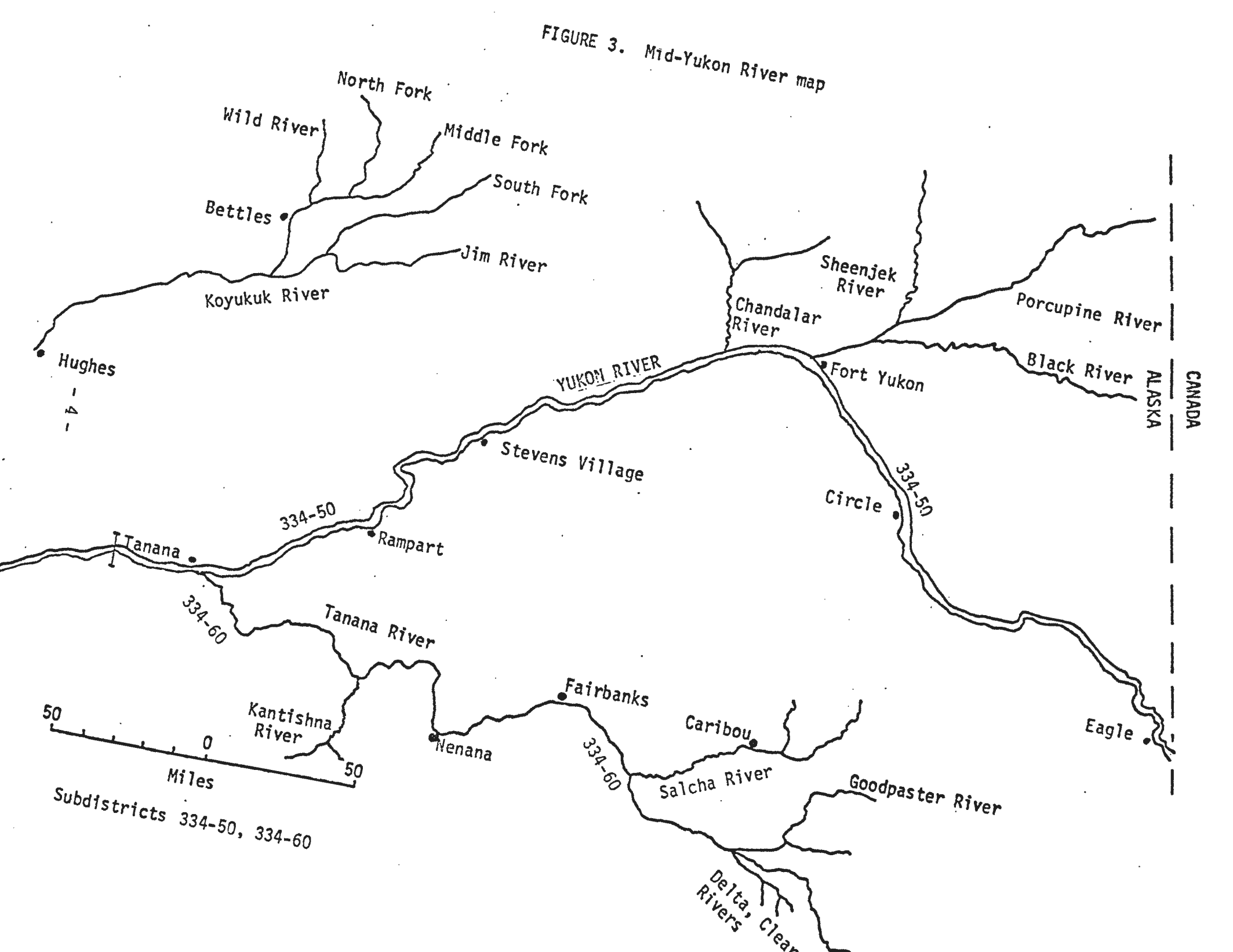
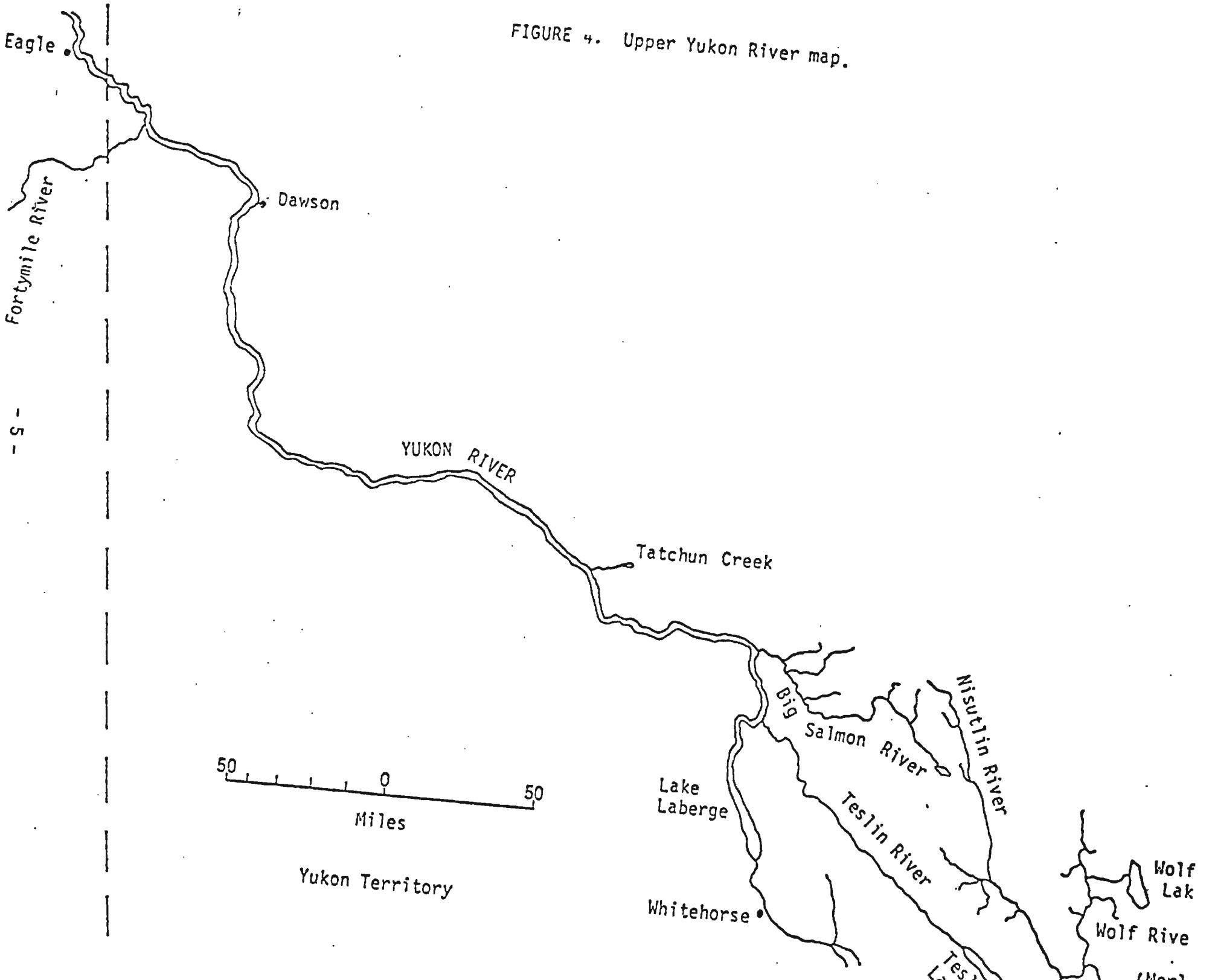


FIGURE 4. Upper Yukon River map.



Study Objectives

The current study was initiated in 1974 to: (1) develop estimates or indices of the magnitude of king and chum salmon escapements in selected tributary streams, and document extent and locations of major spawning grounds; (2) determine age, sex and size composition of king and chum salmon escapements; and (3) determine the size and effect of commercial and subsistence harvests on various stocks of king and chum salmon.

This report reviews data collected during the 1975 field season. Pertinent comparative data collected prior to 1975 or by other projects is also included, historical data is reviewed, data developed by Canadian fisheries personnel in 1975 is presented, and statistical comparisons are made.

Status of Stocks and Fisheries

General: License registration for all types of gear except drift nets were at record levels in 1975. The greatest increase in license registration occurred in the upper Yukon where the commercial fishery is undergoing rapid expansion. A total of 1,190 commercial, 988 vessel, 840 set gill net and 311 drift gill net licenses were issued. More than 100 fishwheels (legal gear but no license fees required) were operated.

Commercial fishing effort within the river is best measured in terms of registered fishing vessels. Effort measured by this criteria, has increased 103% since 1965 [487 vessels in 1965 to 988 vessels in 1975 (Appendix Table 1)]. The majority of the commercial fishermen are Eskimo and Indian residents of the drainage who use small (16-20 foot) outboard-powered skiffs to operate gill nets and fishwheels.

The impact of the increasing Yukon River commercial fishery on local village economies has been considerable. The gross value of the fishery to the fishermen increased 231% from 1965 to 1975 (Appendix Table 1). The wholesale value of the Yukon pack was $4,939,700 in 1975.

Chum Salmon: Historical records indicate that the highest documented chum salmon subsistence catch was 1,400,000 in 1918 (Geiger 1975). As late as 1940, a subsistence catch in excess of 1 million chums was recorded. With a declining dependence by Yukon River residents on dog teams for transportation, subsistence catches of salmon, utilized primarily for dog food, decreased in recent years. Salmon no longer needed for subsistence become available for a developing commercial fishery.

The 1975 subsistence harvest of 279,000 chum salmon was second only to the 1974 catch in recent years (since 1967). There is some indication that the current general trend for individuals "to return to the land" and subsistence type activities also exists among natives living in the Yukon Drainage. The increase in subsistence harvest in 1974 and 1975 may reflect this trend as well as very large chum runs. Appendix Table 2 presents comparative Yukon River chum salmon data.

The 1975 chum salmon commercial harvest for Alaska and Canada totaled 987,000 fish. Commercial catches for this species have averaged 257,000 a year for the period 1961-1975. Record commercial chum catches for 1974 and 1975 reflect very large runs, increased commercial effort, liberalized regulations, and a generally decreased level of subsistence catches from historical levels.

In 1975, a record total of approximately 722,000 summer chums was commercially harvested in the Yukon area. This harvest took place largely in subdistricts 1 and 2 where 75% of the catch was taken.

A total of approximately 265,000 fall chums was harvested commercially in the Yukon area in 1975 as compared to the record catch of 273,000 in 1974. The fall chum fishery has been expanding rapidly in recent years. The Department has established a 250,000 optimum fall chum salmon harvest goal until future returns from current harvest levels have been evaluated. Effective beginning with the 1974 season the Alaska Department of Fish and Game (ADF&G) Board of Fisheries established quotas of 200,000 chum salmon for the lower three subdistricts combined and 50,000 chum and coho salmon for the upper three subdistricts combined.

The 1975 chum salmon escapement of 2,151,884 was the highest observed escapement for the Yukon River drainage (Appendix Table 3). The total run index (catch plus observed escapement) for 1975 was a record high 3,418,160 fish (Appendix Tables 2, 4 & 5). Annual observed chum salmon escapement and total run index since 1971 have averaged respectively 704,020 and 1,520,700 fish.

King Salmon: The 1975 Yukon River commercial king salmon catch of 66,700 was the lowest since statehood and was approximately 37,200 fish less than the previous 14-year average of 103,900. The record high commercial king salmon harvest was 131,893 fish in 1967 (Appendix Table 6).

The subsistence king catch has remained largely static during recent years averaging 15,000-20,000 (Appendix Table 4).

The high seas Japanese fisheries is believed to be, at least in part, responsible for the gradual decline in Yukon king salmon abundance. Japanese high seas gill net catches of Bering Sea's chinook have averaged 179,000 annually since 1960 (Appendix Table 7). These kings are believed to be largely of Kuskokwim River, Yukon River and Bristol Bay origin. Data recently made available, suggests that incidental catches of kings by foreign high seas bottom trawls may also be significant. These harvests coupled with existing domestic fisheries may be contributing to the overharvest of Yukon River kings.

The decreased commercial king salmon catch in 1975 reflects in part substantially reduced fishing time. Below average comparative test fishing and commercial catch data indicated to management personnel a weak return. To ensure at least a minimal spawner escapement, a reduction in the commercial harvest was accomplished by the reduction of commercial fishing time to 2 days a week. The season in the lower river was closed during late June in order to bolster escapements.

For Alaskan and Canadian waters combined observed king salmon escapement has averaged 5,130 since 1972 (Appendix Tables 3 and 8). Observed escapement for Alaskan kings in 1975 was 4,596 and for Canadian kings was 2,109 fish. Aerial enumeration of Alaskan kings for 1975 was more comprehensive than in past years. Canadian king abundance in 1975 as indicated by aerial survey was its highest level since 1971. In general, king salmon escapements in the Yukon River drainage in 1975 were judged fair by management personnel. In 1976 king salmon escapements generally were late in reaching maximum levels on the spawning grounds. The total run index of 91,160 was at its lowest level since 1960 [1960 run index of 78,650 with no escapement figure included and much lower commercial effort (Appendix Tables 4, 6 and 8)].

Coho Salmon: The 1975 commercial coho salmon catch of 2,300 was 17,600 less fish than the previous 5-year average of 19,900 fish. Cohos are generally of minor importance and are taken incidentally to the more abundant fall chum salmon.

Coho salmon escapement documentation is still essentially in the development stage. Tanana River drainage coho escapements, as indicated by surveys of the Clearwater Lake and Delta Clearwater systems, appeared excellent. A total of 10,730 coho were observed on the spawning grounds in 1975 (Appendix Table 9).

Pink Salmon: Few substantial spawning populations of pink salmon have been found within the Yukon drainage. Escapement documentation for

this species has been relatively poor in the past. The Anvik River expanded total count for this species was 1,266 in 1975. A record total escapement of 50,960 pink salmon was documented during aerial surveys of the Andreafsky system in July 1975 (Appendix Table 3).

YUKON RIVER FISHERIES MANAGEMENT AND RESEARCH

Introduction

The in-season assessment of salmon run magnitudes in the lower river commercial fishery is of utmost importance to assure the attainment of escapement needs and a harvest compatible with the principles of maximum sustained yield. The assessment of comparative run magnitudes through the examination of commercial catch data has been made most difficult by the developing nature of the commercial fishery. Catch data are influenced by increasing fishing effort and efficiency, expansion of processing capability, and changes in fishing times.

Department test fishing data is believed to be the best in-season index to adult salmon abundance currently available. There are inherent interpretative problems, however, associated with the use of test fishing data. The present test fishing site is located in the south mouth of the Yukon River. Normally, the greatest numbers of salmon enter the River through this mouth (followed in importance by the middle and north mouths). The importance of the south mouth for migration is believed to shift quite substantially during some years altering catch per unit effort data (C.P.U.E.).

Yukon River commercial fishery catch statistics are recorded on fish tickets when the fish are purchased from the fishermen. The tickets are collected from the processors by Department personnel after the end of each fishing period. From these tickets total catch, C.P.U.E., and number of fishermen are compiled and recorded on a master sheet. These data are readily available to compare with previous years' catches and allow the Yukon Area Management Biologist at Emmonak to make management decisions.

Each year at the summer's end, Department personnel conduct a subsistence fishery survey of the entire river, by boat and aircraft stopping at each village, and interviewing fishermen to obtain the total number of each species of salmon taken and related data. Special catch calendars are mailed to most fishing families prior to the season and facilitate catch reporting. The few fishermen who were not interviewed are sent catch questionnaires after the fishing season ends.

Because of the vast distances involved and the large number of salmon spawning streams in the Yukon River system, salmon escapements are primarily assessed by aerial survey methods. Index streams are chosen which are felt to be indicative of overall Yukon River basin escapements. During the peak of spawning, and when water and light conditions are optimum for viewing, these streams are surveyed by Department biologists in single engine aircraft. While not precise, aerial surveys are an important management tool when no other means of assessing escapements are available. Escapement indices obtained from tower counts and aerial surveys give a post-season check of in-season management strategy in obtainining desired escapement levels.

Flat Island Test Fishing Site

A test fishing site has been maintained at Flat Island in the south mouth of the Yukon River since 1963 (Figures 2 and 5). The Flat Island site is located downstream from most of the commercial fishing gear permitting the salmon run to be assessed before it reaches the commercial fishery. The data obtained from this site has been important for in-season management and in assessing the long-term effects of the commercial fishery on the king and summer chum salmon runs. There have been two primary objectives to this study:

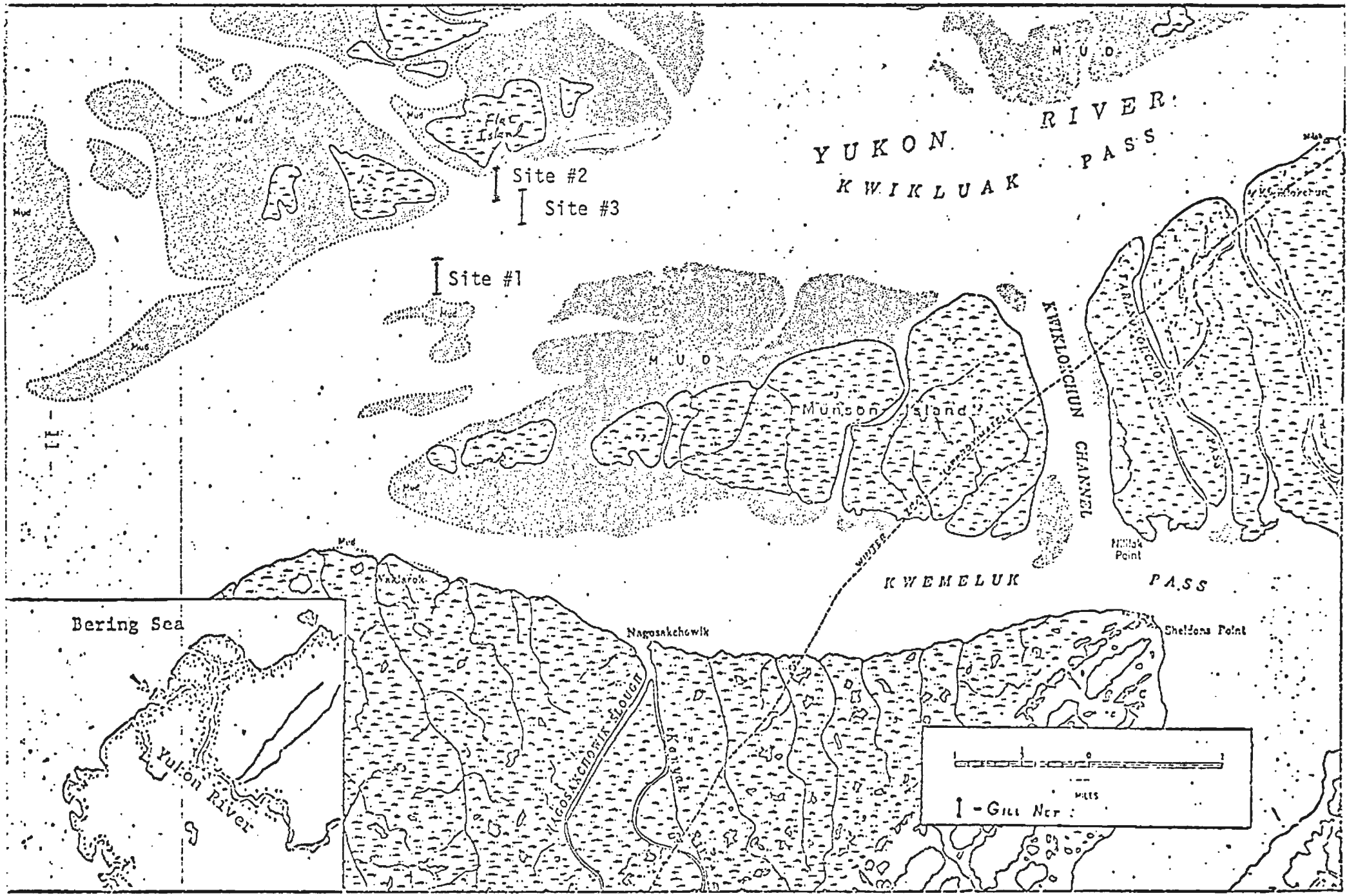
1. To obtain information regarding relative abundance, species composition, and timing of the salmon runs.

2. To obtain information on the effect of the selectivity of 8-1/2" (king salmon gear) and 5-1/2" (chum salmon gear) stretched mesh gill nets on the age, sex and size composition of salmon runs.

Set gill nets of 5-1/2" and 8-1/2" stretched mesh nylon webbing with standard floats and leadline have been used to capture salmon at this site. Each net is 25 fathoms long and the depths of the nets are 28 (8-1/2") and 45 (5-1/2") meshes. The nets were fished 24 hours a day at index locations during June to mid-July. Each net was checked three times each day and the numbers of salmon captured by species and the number of hours fished recorded. Periodically, a sample of the catch from 5-1/2" and 8-1/2" mesh gill nets was taken to obtain age and sex composition.

Test fishing values presented in Appendix Table 10, for the past 9 years are not considered to be absolute indices of relative abundance, but merely show trends in abundance. High values indicate good abundance of

Figure 5. Flat Island test fishing sites, Yukon River, 1975.



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salmon; low values indicate generally poor run levels. For 1975, the king salmon C.P.U.E. of 0.30 was very low (8 year average of 0.67); chum salmon C.P.U.E. of 4.21 was very high (8 year average 2.29).

Salcha River Studies

The Salcha River is the most important king and summer chum salmon producer of the Tanana River drainage (Figure 3). The Salcha River is the only major Yukon spawning system from which data is currently collected from king salmon on their spawning grounds. Smolt outmigration and spawning escapement studies have been conducted on the Salcha River. Results of a Salcha study conducted by cooperating Department personnel are detailed in the 1975 first interim report of the commercial fish-technical evaluation study of the Trans Alaskan Pipeline Impact Report (Francisco 1976).

The summer chum salmon escapement as estimated by surveys in the Salcha River during 1975 totaled 7,573 fish. The annual escapements for this system have ranged from 290 to 8,040 chums (excluding poor to incomplete surveys) (Appendix Table 3).

In 1975 the estimated king salmon escapement for the Salcha River was 1,055. The annual escapement in this system has ranged from 249 to 2,878 kings (excluding poor to incomplete surveys) (Appendix Table 8). For data and discussion of the age, sex and size composition of 1975 Salcha stocks see section on comparative age, sex and size composition of Yukon River chum and king salmon stocks presented later in this report.

Yukon Territory Salmon Escapement Studies

Environment Canada-Fisheries Service personnel enumerated and sampled king salmon migrating through the Whitehorse fishway in 1975 (Figure 4). The fishway is located at the Whitehorse Dam upstream of the city of Whitehorse and is one of the farthest upstream king salmon escapement monitoring sites on the Yukon River. Since 1969 the annual fishway counts and the age and sex composition of the run have been used as a possible indicator of the effects of the downriver fishery on king salmon escapement in the Canadian portion of the Yukon drainage. As part of a cooperative data exchange and assistance program with the Canadian Department of Fisheries, the ADF&G supplied a technician to monitor the fishway in 1970-71 and 1973-74. The objectives of the study over the years have been to: (1) obtain a daily and seasonal count of king salmon escapement

through the fishway and (2) determine the age, sex and size composition of the Whitehorse escapement.

The Whitehorse facility is a weir and pool-type fishway. It is a trough-like timber structure with baffles to create a series of elevated pools which the fish must negotiate to reach the impoundment above the dam. About two-thirds of the way upstream a holding pool with a gate and viewing window are built into the fishway. Salmon are counted and sampled at this point before being released to continue through the fishway.

Three-hundred and thirteen king salmon were enumerated at the Whitehorse fishway in 1975. This count is only 48% of the previous 16-year annual average of 654 fish (Appendix Table 11). An examination of the annual escapement counts since 1959 indicates that the Whitehorse run has experienced a gradual decline. Possible reasons for the decline are discussed in detail in the 1973 Yukon River Anadromous Fish Investigations report (Trasky 1973).

During 1975, aerial and foot surveys were conducted on major spawning streams with ADF&G personnel participating in some surveys. Appendix Table 3 presents salmon escapement estimates.

For the fifth consecutive year, Environment Canada-Fisheries personnel monitored fall chum salmon migration into the Fishing Branch River (tributary of Porcupine River) in northern Yukon Territory (see Figure 6). A 10-mile spring fed section of the south fork of this river is a major overwintering, open-water area heavily used by fall chums (Elson 1976). During the past 3 years a weir has been used to obtain a total escapement count. Numbers of chum salmon enumerated past the Fishing Branch weir in 1975 was an all-time high of 353,000 fish (Appendix Table 12).

A total of 20,600 chum salmon were harvested by commercial and subsistence fishermen in the Yukon Territory during 1975 (Jones 1976). These chums were largely fall fish. Six thousand king salmon were harvested in the Yukon Territory's commercial and subsistence fisheries combined during 1975.

Data on age, size and sex composition of Yukon Territory chum and king salmon stocks sampled during 1975 has been presented under the comparative age, sex and size composition section.

Delta River Studies

Delta River studies were continued in 1975 (Figure 3). The objectives

of the 1975 studies were:

1. Determine the distribution, abundance, and timing of fall chum salmon populations in the Delta River spawning areas.

2. Collect basic life history data on the Delta River spawning population including age and sex composition of the run.

3. Monitor the spawning environment (water temperature and chemistry, sediments).

Data gathered would be useful to document gross changes in environment resulting from the Trans-Alaska Pipeline construction and related activities.

The fall chum salmon escapement for the Delta River was estimated to be approximately 4,000 in 1975, similar to 1974 escapements (Appendix Table 12).

Results of the Delta River studies conducted by cooperating Department personnel are detailed by Francisco (1976). Data on age, size and sex composition of Delta stocks sampled in 1975 has been presented under the comparative age, sex and size composition section of this report.

Aerial Surveys

Intensive aerial surveys of major salmon index streams are begun at the time of anticipated peak escapements. All reasonable efforts are made to fly the streams during ideal, light (mid-day) weather (clear skies) and water conditions (low and clear). Surveys are generally made from a single engine, fixed-wing aircraft. The observer utilizes Polaroid glasses to reduce water surface glare and records estimates of numbers of fish with a tape recorder. Salmon escapement data obtained throughout the drainage in 1975 is presented in Appendix Table 3.

In 1975, king salmon escapements into the major spawning areas ranged from below average to average. Escapements were aided by restrictions placed on the commercial fishery at the mouth. Appendix Table 8 presents comparative king salmon escapement data for selected tributaries (index areas).

Good comparative data is lacking for chum salmon escapements. Summer chum escapements in 1975 were judged exceptionally strong through-

out the drainage based on selected surveys. Both the Anvik and Andreafsky River systems (Figure 2), for which fair historical records exist, had exceptionally large runs in 1975 (Appendix Table 3). In Table 1 the top ten summer chum salmon streams in the Yukon River system are ranked based on numbers of spawners. Most of the streams listed in 1974 were again in the top ten for 1975. The top six Yukon chum streams for 1974: the Anvik, Andreafsky West, Nulato North and South Forks, Gisasa and Rodo Rivers all recorded historically high escapements in 1975. Caribou Creek (Figure 3) ranked eighth with an escapement of 15,000 in 1975 had never been surveyed previously. Of the combined Yukon River summer chum observed escapement for the top ten producing streams in 1974 and 1975 the Anvik River system accounted for 54% and the Andreafsky system 27% as shown in Appendix Table 13.

Table 1. Top ten Yukon River system summer chum salmon streams ranked by escapement, 1974 and 1975 1/2/.

1975		1974	
Stream	Escapement	Stream	Escapement
1. Anvik (Tower count) aerial	813	Anvik (Tower count)	201
2. Andreafsky West	236	Andreafsky West	33
3. Andreafsky East	223	Nulato South	28
4. Nulato North	87	Nulato North	22
5. Gisasa	57	Gisasa	22
6. Nulato South	51	Rodo	16
7. Rodo River	25	Salcha	8
8. Caribou Creek	15		
9. South Fork Koyukuk	15		
10. Melozitna	9		
Total	1,531		340

1/ Escapement in thousands of salmon.
2/ Streams surveyed under poor survey conditions not included.

Aerial surveys continued as the only method currently available to assess fall chum escapement in most Alaskan waters. (See Figure 6 for major Yukon fall spawning areas.) Environmental and light conditions during peak fall chum spawning (late September through mid-November) are generally less conducive to reliable surveys than during the summer. Limited daylight, stream shadowing, streams running ice, and snow squalls are major obstacles.

Aerial survey coverage of fall chum escapements were vastly improved in 1974 when the major Sheenjek and Chandalar populations were discovered. Again in 1975, survey coverage greatly increased with the discovery of additional Toklat River spawning areas.

Due to inclement weather conditions, it was not possible to satisfactorily assess escapements of fall chum in the upper Tanana River drainage in 1975. A new spawning population was documented in Sheep Creek (Chisana River system) a tributary of the upper Tanana River. Sport Fish personnel also found a few spawning chums near the mouth of the Volkmar River, a tributary of the upper Tanana River.

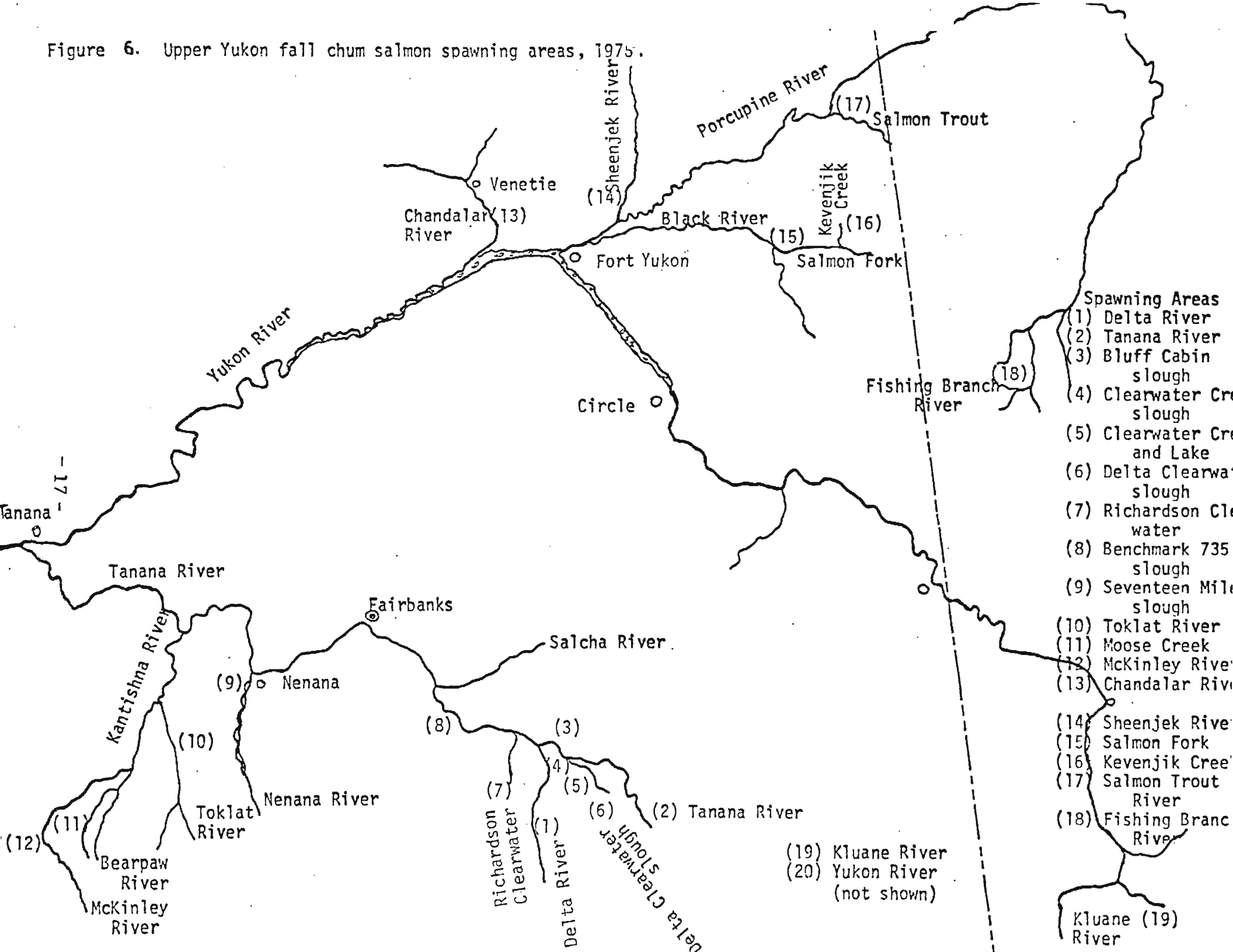
Record fall escapements were observed for the Toklat (78,300), Sheenjek (78,100) and Fishing Branch Rivers (353,300) during 1975 (Appendix Table 12). These three streams accounted for 90% of total documented fall chum escapements for the years 1974 and 1975 combined (Appendix Table 13). In Table 2 the top ten fall chum salmon streams for 1974 and 1975 are ranked based on numbers of spawners.

Table 2. Top ten Yukon system fall chum salmon streams ranked by escapement, 1974 and 1975 [1/].

1975		1974	
Stream	Escapement	Stream	Escapement
1. Fishing Branch Weir	353	1. Sheenjek	41
2. Toklat [2/]	78	2. Toklat	34
3. Sheenjek	78	3. Fishing Branch Weir	33
4. Yukon River (Mainstem Canada)	7	4. Chandalar	17
5. Chandalar	6	5. Bluff Cabin Slough	5
6. Bluff Cabin Slough [2/]	6	6. Tanana	5
7. Delta	4	7. Delta	4
8. Bear Paw	2	8. Bear Paw	3
9. Black [2/]	2	9. Black	2
10. Delta Clearwater Slough [2/]	1	10. Seventeen Mile Slough	2
Total	536		146

1/ Escapement in thousands of salmon.
2/ Poor survey conditions.

Figure 6. Upper Yukon fall chum salmon spawning areas, 1975.



A record total escapement of 533,400 fall chums was observed for all streams during 1975. A total of 149,300 had been the previous record fall chum escapement (1974).

ANVIK RIVER SALMON ESCAPEMENT STUDIES

Introduction

Escapement data shows the Anvik River to be the single most important chum salmon producer in the Yukon system. For the years 1974 and 1975 combined the Anvik system accounted for 54% of the observed escapement of summer chums into the ten most productive streams.

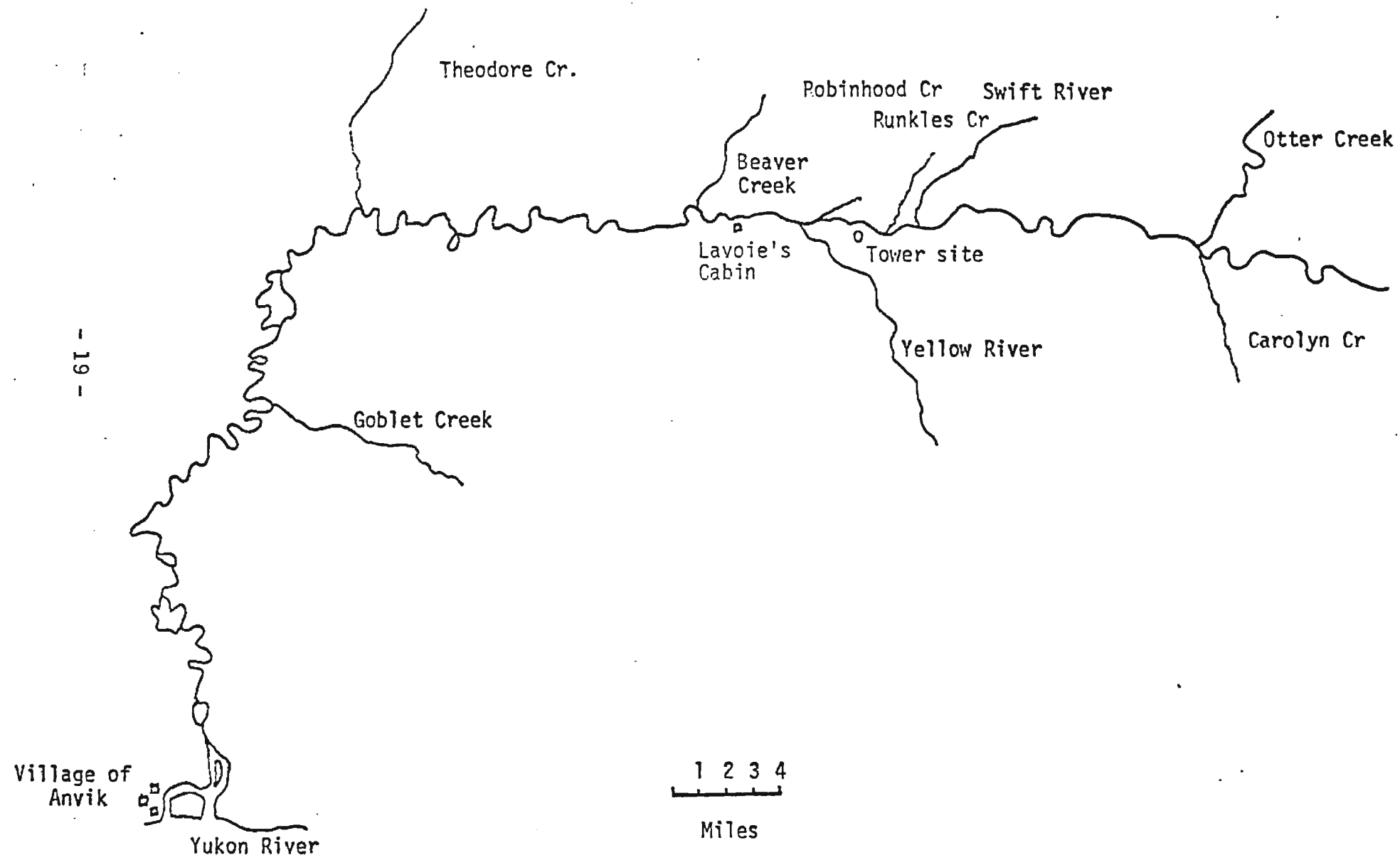
Other species present in this system include king salmon, coho salmon, pink salmon, char, grayling, broad whitefish, round whitefish, pike, slimy sculpin, stickleback, blackfish, and Arctic lamprey.

The Anvik River flows in a southeasterly direction for 140 miles to enter the Yukon River 1-1/2 miles north of the village of Anvik (Figure 7). The upper portion of the drainage is mountainous with elevations generally ranging from 1,000 to 2,500 feet. Toward the river mouth, the terrain is of lesser elevation or about 500 feet. Vegetation along the stream bank includes cottonwood, spruce, willow, tamarack, alder, grasses, and sedges. Throughout most of the length of its main channel the Anvik is a relatively stable stream with a streambed generally of gravel composition; above Swift River much of the streambed is bedrock.

The U.S. Fish and Wildlife Service in a 1957 reconnaissance survey calculated the discharge at 5,670 c.f.s. and the velocity at 4.5 feet per second at a point 6 miles upstream of the mouth. The average depth and the width at this point were 7 feet and 225 feet respectively. Water levels were at flood stages when these measurements were taken during late August-early September. Department personnel in late July of 1975 calculated the discharge to be 2,403 c.f.s. at a point 3-1/2 miles below Theodore Creek. The river was at low stage during this time with an average depth of 2.15 feet, width of 250 feet, and midstream velocity of 4.47 ft/sec.

The Anvik River is a clearwater stream except during periods of high discharge when it becomes turbid. Clearwater conditions, which permit the visual enumeration of salmon, however, are the exception rather than the rule downstream of the Yellow River mouth.

Figure 7. Anvik River Map



In 1974 upstream water temperatures had reached 51° F by June 16; in 1975 upstream water temperatures of 50° F were not recorded until July 4 (Appendix Table 14). A Ph range of 7.5 to 8.5 was documented at the tower site in 1974 (Trasky 1975). During 1975 studies, a low of 8.8 ppm dissolved oxygen was measured following the peak of salmon spawning on July 21; a high D.O. of 13.8 ppm was measured July 6 prior to the beginning of spawning.

For the fourth consecutive year a salmon enumeration project was conducted to yield indices to the magnitude of king and summer chum salmon escapements in the Anvik River system. The objectives of this project were to (1) determine the daily and seasonal timing and magnitude of the salmon escapements, (2) evaluate various enumeration methods by comparing aerial survey, boat survey, and tower counts, (3) determine age, sex, and size composition of the king and chum salmon escapements, (4) continue the evaluation of an 18-hour counting tower schedule and (5) measure climatological and hydrological conditions.

Due to funding limitations, it was necessary to reduce the daily counting tower schedule from 24 to 18 hours beginning with the 1974 season. A decision was made to count during those hours in which the greatest percentage of chum migration was documented in 1973, i.e., 2400 to 0700 and 1300 to 2400 hours. In 1973 these hours included 81% of the chum and 73% of the king salmon daily migration past the tower. Limited data available from 1972 indicated that 79% of chum and 75% of king salmon migration occurred during these hours. Studies by Hurd (1970) indicated that the daily migration patterns for chum salmon in Norton Sound did not change significantly from year to year.

Materials and Methods

Materials and methods were similar to those used by Trasky in 1974 (Trasky 1975).

A 22-foot prefabricated aluminum tower was erected on the east bank of the Anvik River about 5-1/2 river miles upstream from its confluence with the Yellow River (Figure 8). An 80-foot weir was constructed out from the west bank, directly opposite the tower, to direct salmon into that area which could be most readily observed from the tower. A 20-foot section of weir was also put in place out from the tower on the east bank to further restrict the area of salmon migration and expedite counting.

The generally very high water levels during the 1975 field season

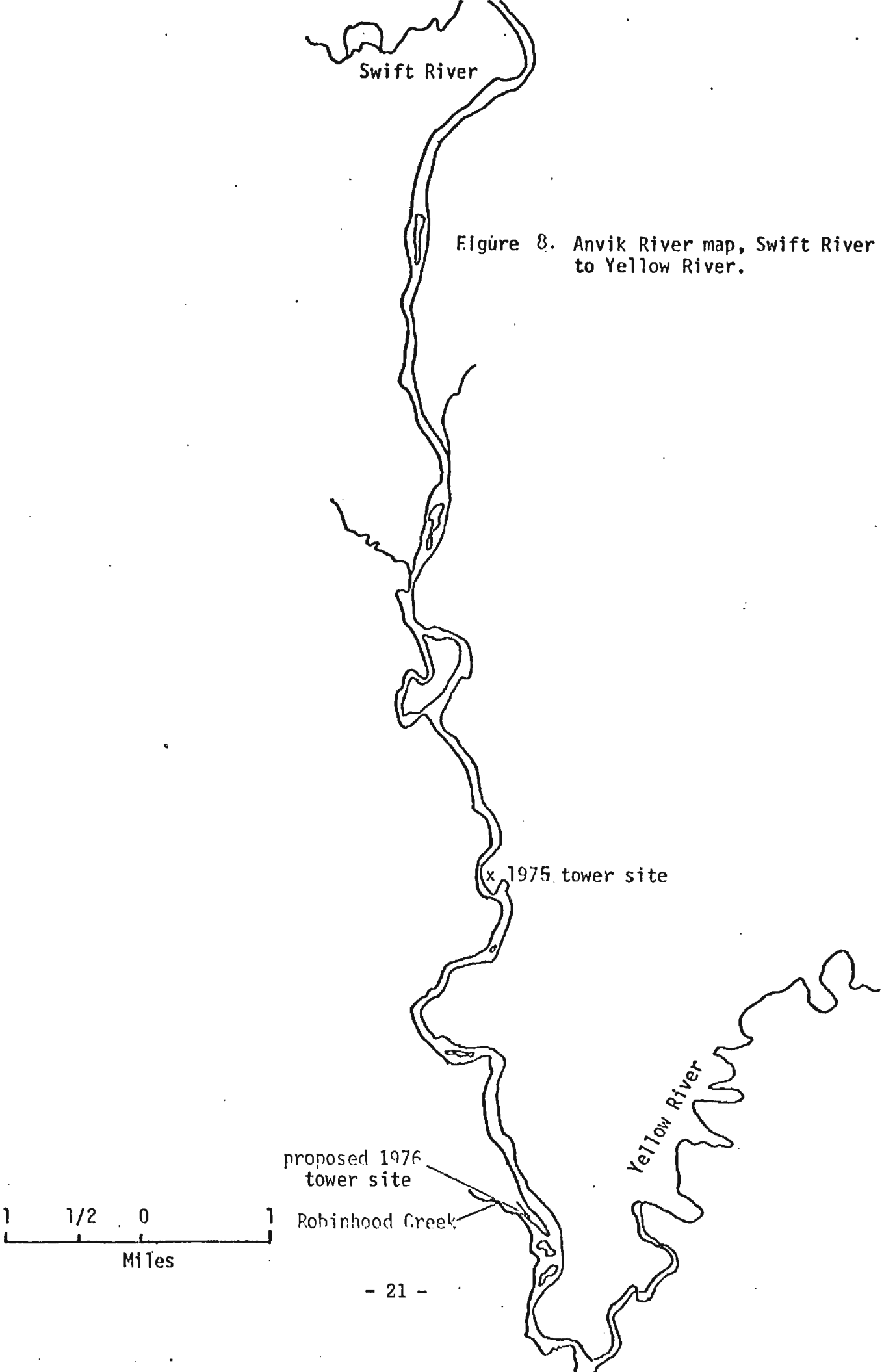


Figure 8. Anvik River map, Swift River to Yellow River.

made weir installation extremely difficult. Final installation was accomplished by the extensive, innovative use of wet suits, snorkle, and face masks.

A power line, incorporating four 300-watt light bulbs housed in 18-inch diameter reflectors, was strung across the river to provide illumination during darkness. A 1500-watt generator provided electric current for the lights.

A background panel to enhance fish visibility was provided by laying an 80-foot x 3-foot panel of white herculite upholster cloth across the stream bottom between the tower and weir. The panel was attached to a cable running across the bottom and weighted down with sandbags and steel beams.

A three-man crew began daily 18-hour counting operations on July 6. Counting was terminated on July 27 with the decline in the chum salmon run. High water occurred throughout most of the run which required changes in counting procedures. On July 15 and 16 extremely high, turbid water conditions made counting impossible and counts for these dates were estimated by using the July 14 and 17 average count. Due to generally high water conditions after July 13, salmon could usually be observed only in that portion of the stream closest to the tower. During this period, salmon were also counted from the end of the west shore weir during certain hours. In order to minimize the effects of stream conditions, various conversion factors were utilized in expanding the counts (see Appendix Tables 15 through 19).

Increased counting effort made it necessary to add an additional person to the crew. It was found to be very fatiguing for an observer to spend over 2 hours counting at a stretch with longer counts likely resulting in high counting error. Counting shifts were consequently held to a minimum of 2 hours.

Salmon swimming downstream were subtracted from the upstream migrants to obtain a "net upstream count". Incomplete daily counts were estimated by computing the percentage (P) of total count made during the missing hour(s) for all other days over the entire season. This percentage (P) was subtracted from 100 percent (1-P) and divided into the daily count (A) to produce an expanded 18-hour total (E) or:

$$\frac{A}{1-P} = E$$

Hourly counts were calculated by taking the same percentage (P) of the

expanded daily total and substituting it for the missing hourly counts. The daily 18-hour count was then expanded by 1.27 for kings and 1.19 for chums to give a 24-hour total. For pink salmon no conversion factor has been developed, hence actual daily counts were expanded in direct proportion to the percent of the hours not counted to give an expanded total. (See Appendix Table 20 for illustrations of the above and other calculations used in this report.)

The size of king salmon passing the tower was estimated by comparison with models attached to the background panel. The size classifications were < 500 mm (trout size), 501-600 mm (chum size), 601-800 mm (average kings), and > 801 mm (large king). These estimates were developed to hopefully approximate the size composition of the king salmon escapement.

Chum salmon carcass sampling and enumeration surveys were conducted from boats upstream and downstream of the tower site from July 25 to August 1. A scale smear was taken from each fish examined, the length (mideye to fork of tail) measured, and sex of each carcass was recorded.

An aerial survey was made of the Anvik River on July 23. Drift or boat surveys were made to enumerate king salmon from August 2 through August 7. A beach seine was used to locate and capture king and coho juveniles for age/growth data. Climatological information was recorded daily. Stream flows and limnological data were taken periodically.

Results and Discussion

Expanded tower counts for 1975 by species were: king - 548, pink - 1,366, and chum - 601,868 (Table 3).

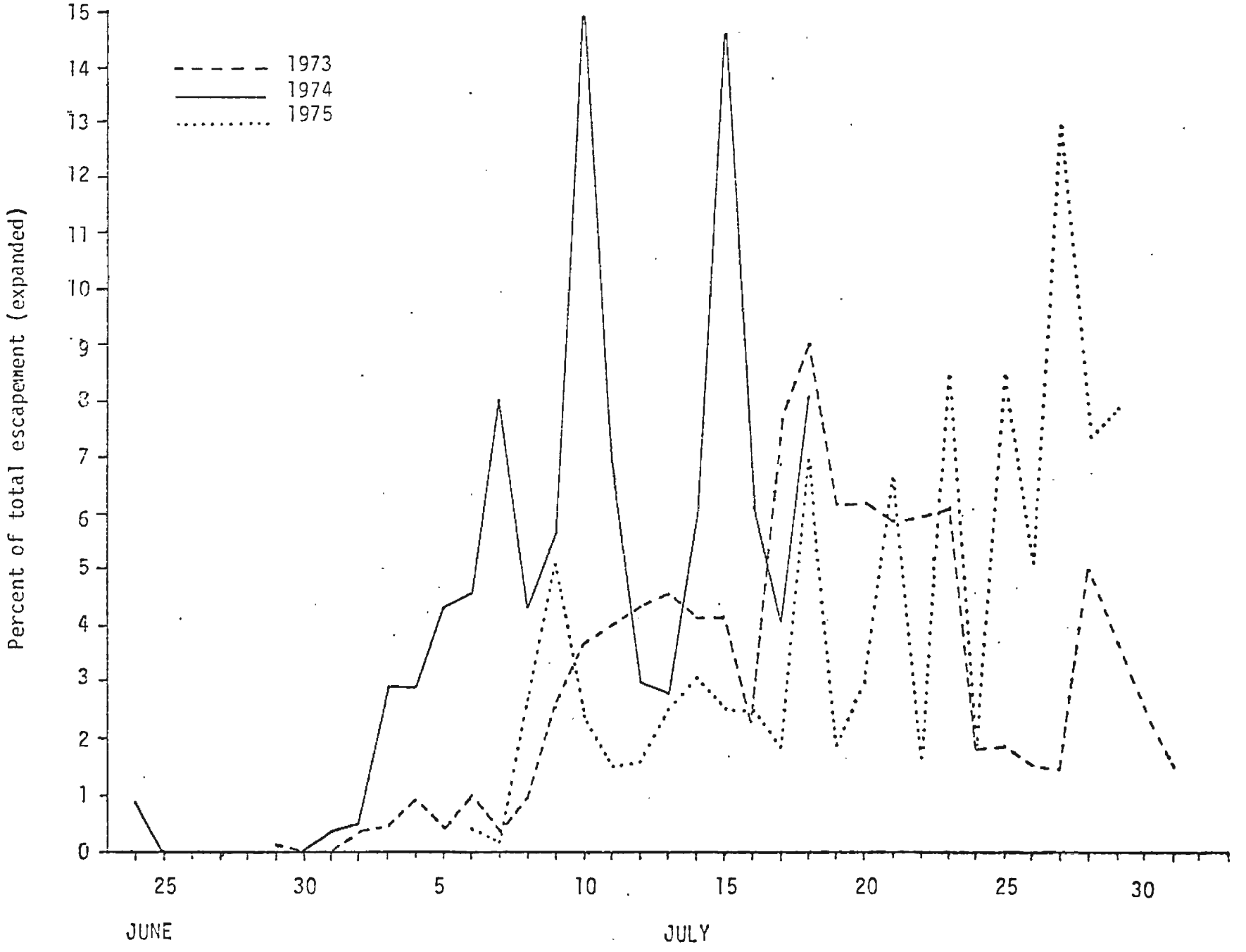
King Salmon: Migration of spawners past the tower in 1975 was approximately 7-11 days late compared to the three previous seasons (Figure 9). King salmon migration through the downstream commercial fishery was similarly late.

Despite frequent poor counting conditions and substantial numbers of fish moving past the tower when operations were terminated, the expanded tower count of 548 was the largest since the 1972 count of 1,104 (Table 5). The 1974 count of 471 was judged approximately 40% low due to high water conditions which forced early project termination on July 19 (Trasky 1975). Actual numbers of king salmon migrating past the tower in 1974 and 1975 were probably similar.

Table 3. Daily net upstream salmon counts (expanded), Anvik River tower, 1975.

Date	King Number	%	Pink Number	%	Chum Number	%
7-6	2	0.4	0	0	10,142	1.7
7	1	0.2	0	0	17,048	2.8
8	14	2.6	0	0	18,599	3.1
9	28	5.1	0	0	44,681	7.5
10	13	2.4	0	0	50,906	8.6
11	8	1.5	5	0.4	36,215	6.0
12	9	1.6	36	2.6	49,855	8.4
13	15	2.7	117	8.6	54,258	9.1
14	17	3.1	136	10.0	68,213	11.3
15	14	2.5	119	8.7	52,784	8.9
16	14	2.5	119	8.7	52,784	8.9
17	11	1.8	101	7.4	37,354	6.1
18	38	6.9	103	7.5	30,415	5.1
19	16	2.9	177	13.0	20,199	3.3
20	18	3.2	133	9.7	16,755	2.8
21	36	6.6	62	4.5	13,390	2.2
22	10	1.8	78	5.7	8,489	1.4
23	46	8.5	57	4.1	7,440	1.2
24	11	2.0	59	4.3	5,173	0.8
25	46	8.5	19	1.4	3,243	0.4
26	28	5.1	39	2.9	2,431	0.3
27	70	12.9	6	0.4	1,496	0.1
28	40	7.3	-	-	-	-
29	43	7.9	-	-	-	-
Total	548	100	1,366	100	601,868	100

Figure 9. Comparison of daily migration patterns for king salmon, Anvik River, 1973-1975.



In Figure 10 king salmon hourly net upstream migration patterns for the standard 18-hour count period are shown for the years 1972 through 1975. This measurement of movement is expressed as the percent of total seasonal migration to pass the counting tower in a given hour of the day. In 1973 Trasky found that king salmon migration was greatest between the hours of 0400 and 2200. The 1975 data showed that king salmon migration peaked between 0200 and 0600 and 1400 and 1500 hours. All years show a lessening of king salmon movement after 1800 hours. During 1972 through 1974, maximum migration occurred between the hours of 1300 and 1700. On July 14 and 19 of 1975, counts were made during the non-standard hours of 0700 through 1200 (Appendix Table 15). Out of a total of 25 king salmon enumerated on those days, 11 or 40% were enumerated during non-standard count hours. In 1973, 27% of the migration occurred during these hours. The 1973 figure has been used in recent years to expand the 18-hour counts. More years of base data are needed before expansion factors can be used with confidence. Data at this point would seem to indicate that hourly migration patterns for king salmon may fluctuate rather widely from year to year rendering an average expansion factor unrealistic (Figure 10).

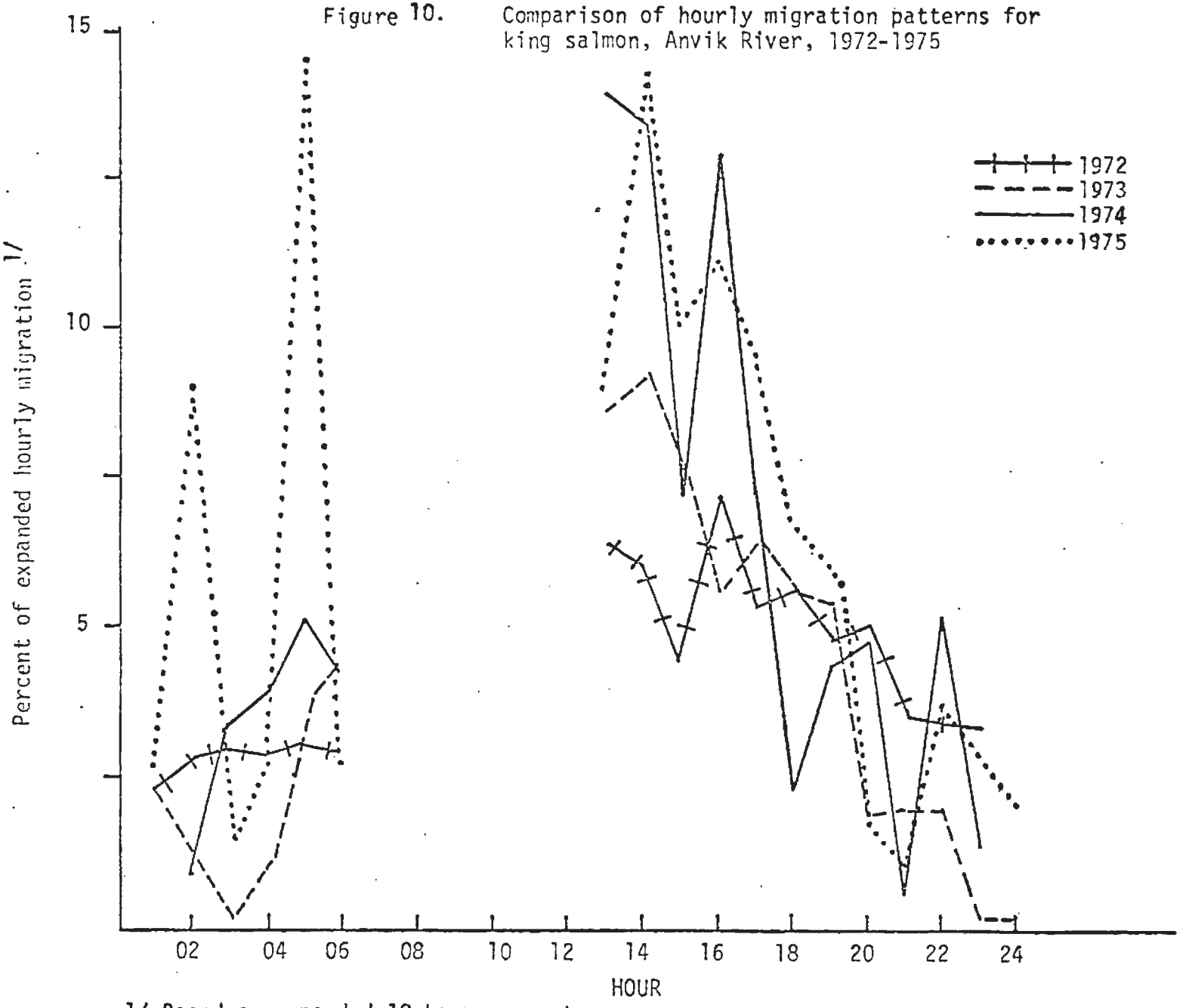
During a July 23 aerial survey of the entire river (except Yellow River), a count of 233 spawners was made (Table 4). This was down substantially from the 12 year average count of 582 (Table 5). The count was judged minimal due to turbid water conditions in the lower river, the "masking effect" of a very large chum salmon escapement, and the fact that the survey was believed conducted too early. Migration past the tower did not peak until July 27 (Figure 9).

Late season boat surveys below the counting tower gave a total king count of 172 as compared to the aerial survey count of 39 for this area. Boat surveys did not include Beaver Creek and stretches of the Anvik below the Roadhouse curve covered by aerial surveys. By the time of the July 23 aerial survey, during which 194 king salmon were counted above the counting tower, 273 kings had been recorded past the tower. Based on aerial and boat surveys, most of the king salmon spawning activity was noted upstream of Beaver Creek.

Since the project was initiated in 1972, very few king salmon carcasses have been sampled and virtually no data has been obtained on the age, sex, and size composition of the Anvik run. The primary problem has been that carcasses are not available in any numbers until the first week in August. Funding limitations have made it necessary to terminate the project before that date.

Based on total length estimates made from the tower, the dominant

Figure 10. Comparison of hourly migration patterns for king salmon, Anvik River, 1972-1975



1/ Based on expanded 18 hour percent.

Table 4. Anvik River king and chum salmon escapement distributions as indicated by aerial and boat surveys, 1975.

River Section	Date	King Aerial	King Boat	Chum Aerial
Below Goblet Cr.	7-23	1		6,800
Goblet - Beaver Cr.	7-23	1		59,425
Beaver Cr. - Roadhouse Curve	8-7		7	
Beaver Cr.	7-23	10		19,005
Beaver Cr. - Lavoie's	8-5		26	
Beaver Cr. - Yellow River	7-23	3		50,900
Lavoie's - Yoder's Cabin	8-4		98	
Yellow R. - 75 Tower site	7-23	24		75,000
Yoder's - Tower site	8-2	___	41	___
Subtotal downstream 75 tower		39	172	211,130
75 Tower - Runkle'Cr.	7-28		52	
Tower - Otter Cr.	7-23	120		345,200
Runkle's - Swift River	7-28		112	
Swift R.	7-23	3		21,545
Swift R. - Otter Cr.	7-28		81	
Otter Cr.	7-23	1		47,645
Otter Cr. - McDonald Cr.	7-23	70		215,250
McDonald	7-23			4,465
Above McDonald	7-23	___	___	250
Subtotal Upstream 75 Tower		194	245	634,355
River Total		233	417	845,485
Tower Count		548		601,868

Table 5. Historical Anvik River king and chum salmon escapements, 1958-1975.

Year	Chum Salmon Tower	Aerial	King Salmon Tower	Aerial
1975	601,868	845,485	548	233
1974	201,277	-	471	-
1973	71,480	26,156	517	222
1972	108,340	208,763	1,104	414
1971	-	-	-	-
1970	-	232,760	-	368
1969	-	-	-	296
1968	-	51,580	-	297
1967	-	116,000	-	336
1966	-	37,000	-	638
1965	-	100,000	-	650
1964	-	13,000	-	-
1963	-	-	-	-
1962	-	-	-	-
1961	-	20,600	-	1,226
1960	-	-	-	1,950
1959	-	200,000	-	350
1958	-	150,000	-	-
Total	982,965	2,001,344	2,640	6,980

		Chum	King
$\bar{X}$	Tower: 4 years	245,741	660
	Aerial: 12 years	166,779	582

size category was 601-800 mm (35.4% of observed kings) which was similar to 1974 results (Table 6). In 1973 the larger size category of over 800 mm was dominant.

Table 6. Estimated size of king salmon migrating upstream past the Anvik River tower, 1973 through 1975.

	Estimated Size 1/									
	Under 500mm		501-600mm		601-800mm		Over 801mm		Total	
Year	No.	%	No.	%	No.	%	No.	%	No.	%
1973	19	4.1	46	9.7	112	23.6	297	62.6	474	100
1974	5	1.4	123	34.4	150	41.9	80	22.3	358	100
1975 2/	16	7.1	59	26.1	80	35.4	71	31.4	226	100

1/ Total length.

2/ Does not include salmon seen but not clearly discernible.

Chum Salmon: The expanded Anvik tower count of 601,868 chum salmon was three times greater than the previous record high count of 201,277 made in 1974. In 1975 chum salmon were not observed in the vicinity of the tower until July 5 with counts beginning July 6 (Figure 11). Lateness of the 1975 chum run, as for king salmon, is believed to have been a function of extremely low early summer water temperatures. The chum salmon migration peaked on July 14 with the passage of an expanded total of 68,213 fish. Ninety percent of the 1975 migration past the tower was completed by July 20. The 90% level was reached on July 15 in 1974 and July 17 in 1973 (Appendix Table 21).

Since 1973, downstream chum salmon movement, expressed as a percent of upstream movement, has varied little with an average of 8.3 (Table 7). If this correction factor continues to be relatively constant from year to year, it will greatly simplify correction of sonar counts. (Available sonar counters, which are planned for use in the Anvik River, do not differentiate between upstream and downstream moving fish.)

Figure 11. Comparison of daily migration patterns for king salmon, Anvik River, 1973-1975.

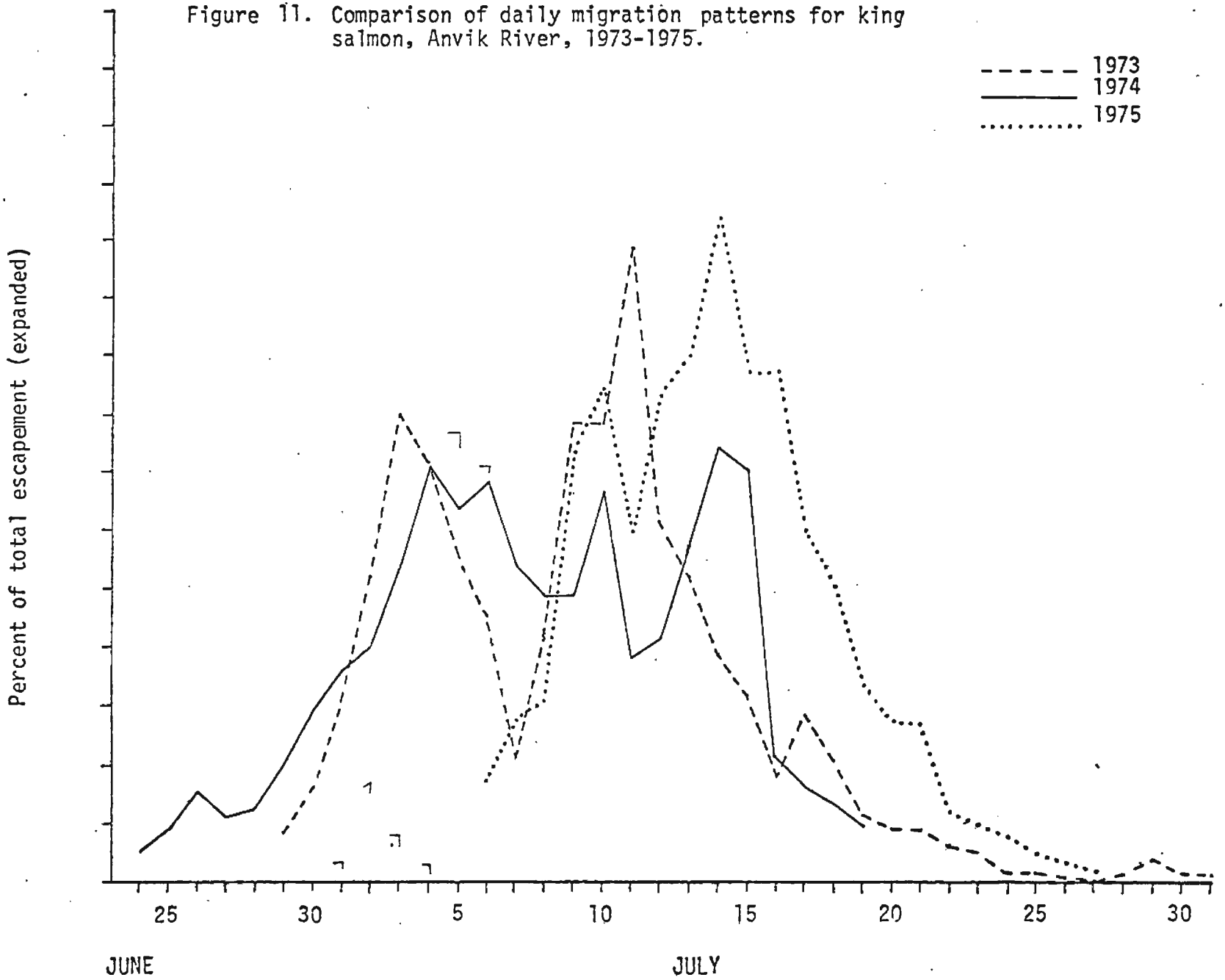


Table 7. Anvik River chum salmon movement compared for years 1973-1975. 1/

Year	No. upstream	No. downstream	downstream movement expressed as % of upstream
1972	65,202	2,239	3.4
1973	76,904	6,483	8.4
1974	149,753	14,629	9.8
1975	284,830	24,511	8.6
Total	576,689	47,862	8.3

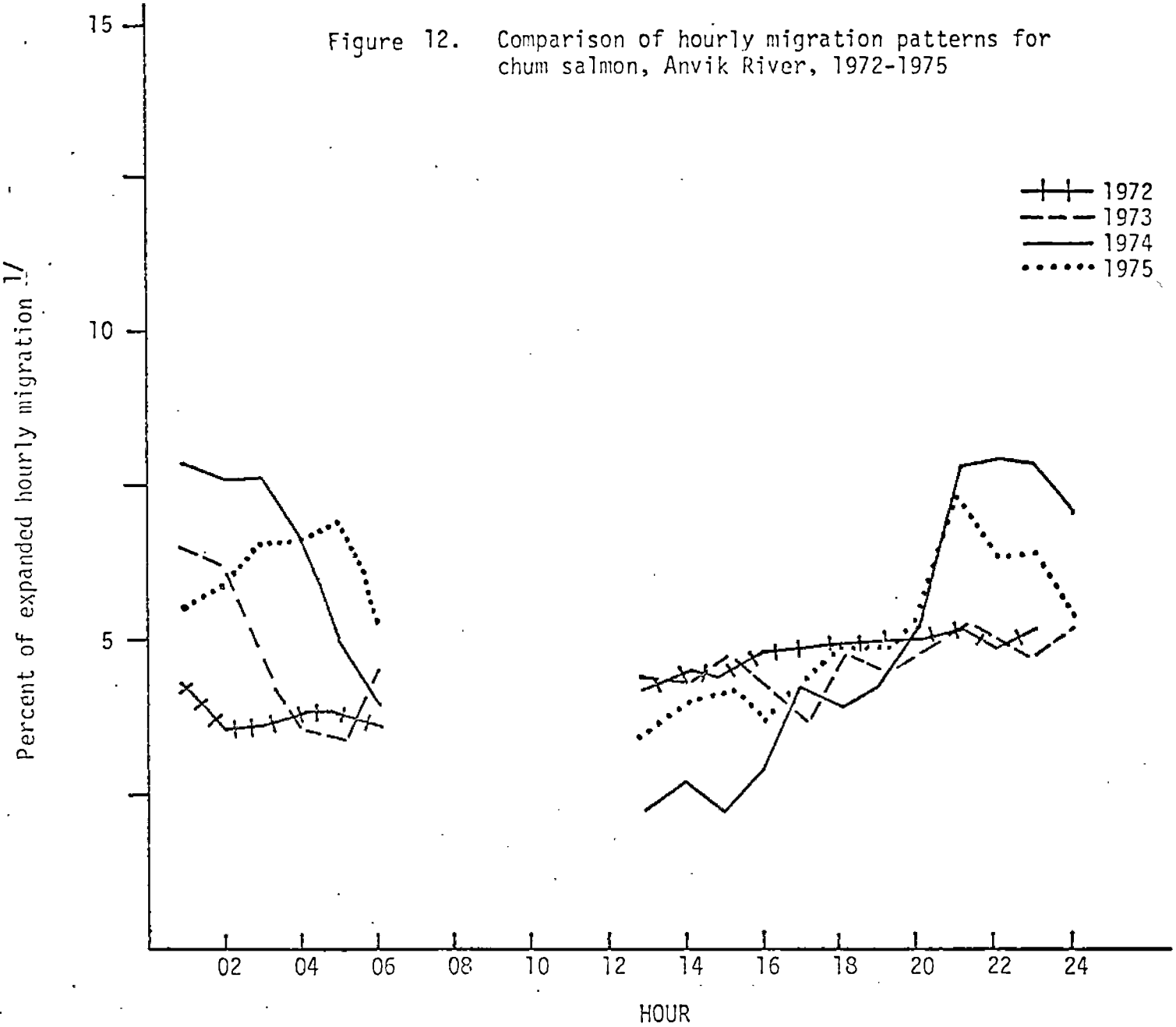
1/ Movement data available through 7/14 only for 1975.

In Figure 12 hourly migration patterns for the same 18-hour period during 1972, 1973, 1974 and 1975 are shown for chum salmon; slight variations between seasonal migration patterns can be noted. In 1975, as in earlier years, migration patterns for hours of actual counts would seem to indicate that the time of reduced movement was between 0700 and 1300 hours. Peak migration was again found to be between the hours of 2200 and 0500. On July 14 and July 19 of 1975, counts were made during the non-standard hours of 0700 through 1200 (Appendix Table 17). Out of a total of 82,389 chum salmon enumerated on those days, 23,165 or 28% were enumerated during the non-standard count hours. In 1973, 19% of the migration occurred during these hours and recent year 18-hour daily counts have been expanded by this percentage. More years of base data are needed before expansion factors can be used with confidence.

A July 23 aerial survey count of 845,485 chums was made for the entire river. The aerial count made upstream of the tower totaled 634,355 fish and compares to a cumulative expanded tower count of 589,518 for the same date. The aerial survey count made downstream of the tower totaled 211,130 fish. The downstream count was very minimal due to turbid water conditions.

Based on limited aerial observations during some low-water, moderate escapement years, it appears that 30% or more of Anvik chums may

Figure 12. Comparison of hourly migration patterns for chum salmon, Anvik River, 1972-1975



1/ Based on expanded 18 hour percent.

spawn downstream of the present counting tower site (Table 8). A post-season boat survey of the Yellow River single largest tributary, showed large numbers of chum salmon carcasses which would indicate that large numbers of chum utilize this stream for spawning. This stream is normally quite turbid; hence, the numbers of actual spawners within this tributary have never been assessed. The observed total escapement of 812,998 chum salmon (tower count upstream plus aerial count downstream) is regarded as a minimal figure (Table 9). It is believed that in excess of one million summer chums spawned in the Anvik system during 1975.

Table 8. Chum salmon spawning distributions above and below the Anvik tower by year.

Year	Aerial Count Below tower	%	Above tower	Total
72	137,520	65.9	71,243	208,763
73	15,190	58.1	10,966	26,156
75	192,130	22.7	653,355	845,485
Total	344,840	31.9	735,564	1,080,404

During beach surveys sex was determined for 13,439 carcasses: 49.8% were males, 50.2% were females (Appendix Table 22). An additional 662 carcasses were sexed and scale sample data collected; of these, 271 were males and 313 were females. A Chi Square test showed that there was no statistical difference in these numbers, if the expected number of males is assumed to be equal to numbers of females (Appendix Table 23).

Table 9. Anvik River best escapement estimates for 1975. 1/

	King	Chum	Pink	Coho	Total
Upper River weir 2/	548	601,868	1,366	-	603,782
Lower River Float	172	-	-	-	172
Lower River Aerial	10 3/	211,130	-	-	211,140
Entire River aerial	4/	5/	-	467	467 5/
Total	730	812,998 5/	1,366	467	815,561 5/

1/ Aerial survey generally rated 60% for chum upper River, 50% or less for lower River.

2/ Expanded counts.

3/ Beaver Creek only.

4/ Poor survey for king salmon.

5/ Entire River aerial figure for chum not used here.

The 1975 chum salmon escapement was overwhelmingly age 4_1 1/ (92.7% of the 584 fish aged (Table 10). In 1973 and 1974 the 4_1 age class was also dominant. For the four years for which data is available, 1972 is the only year with 5_1 age class dominance (79.1%).

Unfortunately, no age or escapement data exists for the 1971 Anvik River brood year chum escapement which gave rise to the 1975 record return. Yukon River escapement data indicates escapements in 1971 were generally good for summer chums. Brood escapements for the Andreasky River system, the only Yukon tributary stream comparable to the Anvik for which good

1/ Gilbert-Rich Formula - total years of life at maturity (large type) - year of life at outmigration from freshwater (subscript).

Table 10. Anvik River percent of chum salmon by age class for years 1972 through 1975.

Age 1/	1972 No.	1972 %	1973 No.	1973 %	1974 No.	1974 %	1975 No.	1975 %	All Years Total No.	All Years Total %
3_1	0		48	6.1	36	9.0	21	3.6	105	5.0
4_1	62	19.4	605	77.3	317	78.9	541	92.7	1,525	73.0
5_1	253	70.1	128	16.3	46	11.4	22	3.7	449	21.5
6_1	5	1.5	2	0.3	3	0.7	0	0.0	10	0.5
Total	320	100.0	783	100.0	402	100.0	584	100.0	2,089	100.0

1/ Gilbert-Rich Formula - total years of life at maturity (large type) - year of life at outmigration from freshwater (subscript).

escapement data exists, totaled 169,850 in 1975. The average for this system since 1966 has been 149,960 fish.

Anvik River chum salmon averaged approximately 553 mm in length for 1975 samples (Appendix Table 24). Male chums were found to be a significantly greater length than females (574 vs. 534 mm). Chums sampled in 1974 were of a significantly greater average length than those sampled in 1975 (565 mm and 553 mm respectively). No significant length difference was detected between the 1975 and 1973 runs (553 and 552 mm respectively). Thus, from data available, escapement magnitude and body length of chum salmon appear to have little correlation for the Anvik River. A relatively weak run in 1973 was composed of small-sized fish, a large size run in 1974 was composed of large-sized fish, and a record run in 1975 was composed of small-sized fish.

Pink Salmon: An expanded total of 1,366 pink salmon was counted past the Anvik tower during 1975, a record high for this system. Pink salmon tower counts for 1973 and 1974 were 286 and 197 respectively. The Anvik River apparently is at the upstream spawning limit for this species in the Yukon system and sustains only a marginal population. During years of large chum escapements, as in 1974 and 1975, pink salmon are probably obscured by the much greater numbers of chum salmon present and counts

are likely much lower than actual numbers. The majority of pink salmon spawn in the middle portion of the drainage.

Miscellaneous Studies: Experimental beach seine operations during late July revealed the presence of juvenile king and coho salmon in riffle and pool areas near the tower site and Lavoie's cabin. On September 24, 18 juveniles were captured in the area of Robinhood Creek. Eleven of these juveniles were examined; six were king salmon (age 0, total length range 64-74 mm), and five were coho salmon (age 0, total length range 53-97 mm). King and coho juveniles were found to be identified best on the basis of characteristic adipose pigmentation: adipose black spotted all over-coho; adipose partially clear at base-king.

Following up reports by long-term Anvik village residents, aerial surveys on September 22 gave the first official documentation of coho spawning within the system. A total of 467 spawning coho was observed largely within Beaver Creek and Swift River. A high percentage of these cohos were still bright and silvery in appearance at time of the survey. Counts were made very difficult by the nature of the preferred spawning habitat - very narrow, twisting streams with beaver dam impoundments and timber frequently obscuring the stream channel. Canyon Creek and other Anvik tributaries not surveyed may also have spawning coho populations. Thus the above figure likely represents a very minimal record of coho escapement.

Source of Error: High water levels on numerous occasions throughout the study made enumeration of salmon from the counting tower difficult, if not impossible. Estimation of fish passage became necessary at such times with obvious possibilities for error. Methodology of counting, e.g., counting from both stream banks, gave results which may not readily compare to the counts of past years. It is felt that water depth, width of counting area, water turbidity, sunlight reflection, and sheer volume of the 1975 migration would have rendered a very low count if counts had been conducted from the tower exclusively - with perhaps 50 to 75% enumeration. Observations during 1975 seemed to indicate that most chum salmon movement was along either bank where a lesser current was encountered (2.3 ft/sec bank velocity, midstream velocity 5.0 ft/sec, July 17). King salmon would appear to migrate up midchannel as readily as they do along the banks.

Chum salmon, during the peak of migration, were passing at the rate of over 3,600 per hour (1/sec) with the highest rate of movement during the hours of semidarkness to darkness. The counter was expected to enumerate upstream and downstream migrants of three salmon species. Even with the use of hand tallying devices, inadvertent counting error would be present when large numbers of fish were passing. Counting error, although undocumented, probably results in low counts.

SPECIAL STUDIES

Introduction

Management personnel agree that major downstream Yukon fisheries are dependent upon mixed salmon stocks in respect to spawning grounds origin. If the fishery is to be managed on a maximum sustained yield basis it is essential that these stocks be identified within the fishery and abundance evaluated.

Age, length, and sex data have been collected for chum and king salmon by surveys of representative spawning streams, by sampling commercial catches, and from department test fishing catches. Data collected reflects year to year changes in age, sex, and size composition of stocks.

In the future, it may be possible to separate stocks of Yukon salmon by differences in scale characteristics or by electrophoresis analysis.

Fall and summer chum are currently separated out on the basis of morphological and run timing characteristics with some degree of confidence. It is theorized by management personnel that stocks destined for particular streams may move up river as relatively homogeneous units. The upstream movement of such a stock for a large system, as the Sheenjek would be reflected as a peak of abundance in commercial catches. The validity of this theory and the timing of the movement of respective stocks through the commercial fishery could likely be assessed by undertaking a major tagging study.

Sheenjek River

Although fall chum have comprised an increasingly important portion of the total Yukon River salmon catch, very little information regarding their life history, abundance, and distribution was available before 1972. All the known fall chum spawning areas in the Yukon drainage are located upstream of the mouth of the Tanana River. In most instances fall chum spawning areas are believed to be in areas of upwelling ground water with winter water temperatures above 34° F.

The spawning population of the Sheenjek (Figure 6) represents a major percentage of the entire Yukon fall chum spawning population (of the top ten production systems 28% observed in 1974 and 15% observed in 1975, Appendix Table 13). During the fall of 1975 a feasibility study was initiated

on the Sheenjek to determine: (1) suitability for a stream life study, and (2) practicality for counting tower enumeration. A total of four aerial surveys were made of this stream to document escapement and locate potential weir and study sites. Length and sex data, along with scales, were taken from spawned out salmon during the on-site study at Fish Slough and at Russell's cabin.

The 1975 peak aerial survey count of Sheenjek fall chums was 78,100 fish. In late September an ideal stream life study area, locally known as Fish Slough, was located some 50 miles upstream from the mouth of the Sheenjek (Plate 1). An estimated 5,000 to 8,000 chum salmon spawned in this old channel of the main river. Daily temperature records cited below showed this to be a typical example of a "warm water" chum fall spawning area.

Date	Time	Water Temperature °F		Air Temperature
		Main Channel	Fish Slough	
10/29	1700	33	37	26
10/30	0930	34	39	31
10/30	1445	36	42	44

This area was easily accessible by wheeled aircraft from Fort Yukon.

Major Sheenjek spawning concentrations of chum salmon were identified in six areas. The first major area located was approximately 1 mile above the Bill Barnes cabin (20 minutes flying time upstream from River mouth). The farthest upstream area of major importance was approximately 2 miles above the haystacks area.

Several good potential counting tower sites were located in the lower River. During a low water fall, as 1975, it would appear feasible to establish an enumeration site at the River mouth.

Sheenjek River fall chum sampled were significantly larger (553 mm) in 1975 than were Anvik River summer chums sampled (590 mm, Appendix Table 24). However, in 1974 no significant difference was detected in the average lengths of these two stocks.

A highly significant difference in average length was found for Sheenjek fall chums sampled in 1974 and 1975 (562 mm and 590 mm respectively). Within the Sheenjek, no size difference was found between samples from the Fish Slough and Russell's Cabin area. Little difference was detected in the average lengths of fall chum of different origin as

Plate 1. Sheenjek - Fish Slough Study Area

shown by a comparison of Sheenjek and Delta length data for 1975. Delta River fall chums averaged 591 mm in length; Sheenjek River fall chums averaged 590 in length.

Age data from two major spawning areas (Fish Slough and Russell's Cabin) showed the Sheenjek sample to be 94.9% age 4_1 (see Table 14). In 1974 the Sheenjek River sample was predominantly of 3_1 fish (66%) with 4_1 fish comprising 30% of the sample. The Sheenjek River fall chum sample for 1975 was predominantly female (60%). The 1974 Delta River sample was composed of 54% 3_1 fish and 44% 4_1 fish (Trasky 1976).

Age, Length, and Sex Data for Miscellaneous Yukon Stocks

King Salmon: Table 11 provides the size composition of the 1975 Yukon River king salmon run as reflected by samples from commercial catches, limited samples from spawning grounds, observations of the Anvik tower, and by samples from the Whitehorse Fishway. In general discussion and analysis only distinct population segments will be dealt with here. A total of 2,205 kings were included in the sample.

The size structure of the Salcha River king salmon spawning ground carcass sample was 48% large (over 801 cm) and 33% medium (601 - 800 mm). For Anvik River kings (sizes visually estimated only), the dominant size category was medium, 35.4% of fish observed. All Yukon Territory's kings sampled at the Whitehorse fishway were in the medium (31.7%) and large (68.3%) size categories. The categories of jack (precocious males) and small kings were entirely lacking at this location.

Scale samples were aged from 203 king salmon sampled on the Salcha River spawning grounds. Of these 36.5% were age 6_2 and 32.5% were age 5_2. The 4_2 age class at 25% was well represented in samples (Table 12).

Scale samples were collected from king salmon in the Dawson gillnet and fishwheel fisheries. Fishwheel catches were 55.1% 4_2 fish and gillnet fish were older with 43.7% from the 5_2 age class which resulted from the differential size selectivity of the gear (see below). Insufficient numbers of scales were taken from Whitehorse kings during the 1975 season to give an indication of the age composition of that run.

A highly significant chi square value was found when a comparison was made between fishwheel catches by size category and all other king salmon size categorized (Appendix Table 25). Fishwheel selectivity for the smaller size classes is definitely indicated.

Table 11. Numbers and percentage of king salmon by size category, Yukon River system, 1975 1/

Location	Jack Under 500mm	%	Small 501-600	%	Medium 601-800mm	%	Large over 801mm	%	Total	
	n		n		n		n			
Anvik 2/	16	7.1	59	26.1	80	35.4	71	31.4	226	100
Emmonak Gillnet			46	5.3	243	27.9	581	66.8	870	100
Chena 8/11-12 Escapement			9	16.1	26	46.4	21	37.5	56	100
Salcha 8/12-14 Escapement	4	1.6	44	18.1	79	32.5	116	47.7	243	100
Galena Gillnet	3	2.7	39	34.5	31	27.4	40	35.4	113	100
Tanana Gillnet					1	6.7	14	93.3	15	100
Manley Hot Springs Gillnet	1	20.0	2	40.0	1	20.0	1	20.0	5	100
Nenana Fishwheel	11	6.1	86	48.0	59	33.0	23	12.8	179	100
Gillnet			5	9.4	17	32.1	31	58.5	53	100
Galena Fishwheel	2	2.9	37	53.6	15	21.7	15	21.7	69	100
Canada										
Dawson City Fishwheel	4	1.5	52	18.9	136	49.5	83	30.2	275	100
Whitehorse Fishway					32	31.7	69	68.3	101	100

1/ Length mid-eye to fork of tail.

2/ Estimated total length from Anvik tower observations.

Table 12. Age compositions of king salmon samples - Yukon drainage, 1975 1/

Study Area		3_2 No.	3_2 %	4_2 No.	4_2 %	5_2 No.	5_2 %	6_2 No.	6_2 %	7_2 No.	7_2 %	Total	
Anvik R.	carcass			1	12.5	5	62.5	2	25.0	0	0	8	100
Chena R.	carcass			13	26.0	24	48.0	10	20.0	3	6.0	50	100
Salcha R.	carcass	1	0.5	51	25.0	66	32.5	74	36.5	11	5.5	203	100
Emmonak	fishwheel			61	7.4	326	39.5	298	36.2	139	16.9	824	100
Galena	fishwheel	1	1.7	33	55.0	15	25.0	10	16.7	1	1.7	60	100
Tanana	gillnet					2	11.1	14	77.8	2	11.1	18	100
Nenana	setnet			6	12.8	30	63.8	9	19.1	2	4.3	47	100
Nenana	fishwheel	4	2.6	92	59.7	44	28.6	12	7.8	2	1.3	154	100
Canada Dawson City													
gillnet				19	20.2	41	43.7	24	25.5	10	10.6	94	100
fishwheel				108	55.1	70	35.7	14	7.1	4	2.0	196	100

1/ King salmon were aged by scale samples read by various region staff.

In the Salcha spawning ground sample male kings, 59.5% of kings examined, were found to be significantly more abundant in 1975 than were females (Table 13). Of 56 king carcasses sampled from the Chena system, males also predominated (54.5%). For Emmonak commercial gillnet samples there was no difference in numbers of male and female fish which probably was the result of the size selectivity of the gear, i.e., the smaller males not being harvested.

Table 13. Sex composition of king salmon sampled by study area - Yukon drainage, 1975.

		Males		Females		Total	
Chena	carcass	31	55.4	25	44.6	56	100
Salcha	escapement	135	59.5	92	40.5	227	100
Emmonak	gillnet	469	50.5	479	49.5	948	100
Galena	gillnet	24	40.0	36	60.0	60	100
Tanana	gillnet	11	61.1	7	38.9	18	100
Nenana	setnet - gillnet	26	55.3	21	44.7	47	100
Nenana	fishwheel	125	81.2	29	18.8	154	100
Whitehorse fishway		167	53.5	145	46.5	312	100
Dawson City	gillnet	82	87.2	12	12.8	94	100
	fishwheel	182	92.9	14	7.1	196	100

Chum Salmon: Emmonak summer chums from the gillnet fishery (cut off date July 16) were found to average larger than Anvik chum carcasses (respectively 576 and 553 mm, Appendix Table 24) which, again probably results from gear selectivity. No real length difference was noted for Emmonak summer chum when 1974 and 1975 data was compared. From spawning ground sampling a highly significant difference in length was found for Anvik 75 (553 mm) and Sheenjek 75 (590 mm) chums. Salcha River 1975 chums (564 mm) were found to be of a statistically significant greater

length than 1975 Anvik River chums, (554 mm), but this difference of just over a centimeter is likely of little real biological meaning.

Age data for chum salmon by study area and combined sampling methods is presented in Table 14. For 1975 the age category 4_1 was predominant in all samples ranging from a low of 77.8% (Chena River) to a high of 96.4% (Emmonak-July). Age 3_1 fish were at their highest percentage in the Manley (16.6%) and Nenana (16.9%) samples. Age 5_1 fish were at their highest percentage in Chena (19.4%) samples.

Table 14. Age comparisons for chum salmon by study area - Yukon drainage, 1975.

	AGE GROUP							
	3_1		4_1		5_1		Total	
Study Area	No.	Percent	No.	Percent	No.	Percent	No.	Percent
				Summer				
Anvik	21	3.6	541	92.6	22	3.8	584	100
Salcha	4	1.5	229	84.5	38	14.0	271	100
Emmonak-June	1	0.3	286	85.3	48	14.3	335	100
Subtotal	26	2.5	1,056	88.7	108	9.0	1,190	100
				Fall				
Emmonak-July	12	1.1	1,043	96.4	27	2.5	1,082	100
Sheenjek	7	5.1	187	94.9	3	1.5	197	100
Delta	8	3.0	253	93.0	10	4.0	271	100
Chena	1	2.8	28	77.8	7	19.4	36	100
Manley	67	16.6	319	78.8	19	4.6	405	100
Nenana	171	16.9	802	78.8	43	4.3	1,016	100
Dawson City	1	1.6	58	90.6	5	7.8	64	100
Subtotal	267	9.0	2,690	87.6	114	3.7	3,071	100

Sex composition of chum salmon samples by study area is presented in Table 15. Although for some 1975 samples, e.g., the Sheenjek sample, significant sex differences were found (Appendix Table 23), no difference was found in abundance of males and females in 1975 total run.

Table 15. Sex composition for chum salmon samples by study area - Yukon drainage, 1975

Study Area	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
Nenana	508	50.0	508	50.0	1,016	100
Manley	209	51.6	196	48.4	405	100
Anvik	6,698	50.0	6,741	50.0	13,439	100
Sheenjek	81	39.9	122	60.1	203	100
Lower Yukon - July	299	27.7	781	72.3	1,080	100
Delta	152	52.5	137	47.5	289	100
Chena	22	57.9	16	42.1	38	100
Salcha	154	49.5	152	50.5	306	100
Lower Yukon - June	198	59.1	137	40.9	198	100
Dawson City	35	54.7	29	45.3	64	100

SUMMARY

Commercial fishing effort within the Yukon area, best measured in terms of registered fishing vessels, has increased 103% since 1965 (487 vessels in 1965, 988 vessels in 1975). The gross value of the Yukon fishery to the fishermen increased 231% from 1965 to 1975. The wholesale value of the Yukon pack stood at $4,939,700 in 1975.

The 1975 commercial Yukon River chinook salmon catch of 66,740 was the lowest since statehood and was approximately 35,000 fish less than the previous 14 year average of 101,379 fish. The subsistence chinook catch for 1975 was 17,710 fish. The 15 year average subsistence chinook harvest (1960-1974) was 19,760 fish.

Low pre-season test fishing values and poor catch success of Japanese

high seas for immatures forewarned management personnel of an apparently poor chinook run for 1975. Due to the indicated poor strength of the king run, fishing time was reduced to 2 days a week during the greater portion of the run. The season in the lower river was closed during late June in an attempt to provide for adequate escapements.

Salmon migration into the Yukon and streams of spawning was generally very late during 1975. In 1975 king salmon upstream movement past the Anvik tower did not peak until July 27; peak Anvik tower king salmon counts were made on July 19th and July 10th for 1973 and 1974 respectively. Anvik River water temperatures did not reach 50 degrees until July 4th in 1975. In 1974, water temperatures of 51 degrees were recorded in the Anvik on June 16th; in 1973 and Anvik water temperature of 61 was recorded on June 27th.

The chinook escapement for the Anvik River in 1975 was estimated to be 730 fish. Anvik aerial survey counts for kings were very low when compared to weir and float counts. Aerial counts were believed to have been made too early to give a meaningful peak king index count. Some historical escapement indices (the 1972 weir count of 1,104 and aerial counts of 1,226 and 1,950 in 1961 and 1960 respectively) were much higher than 1975 indices.

Three-hundred and thirteen king salmon were enumerated at the Whitehorse fishway in 1975. This is the highest fishway king count since 1972, however, this count is only 42% of the average yearly count of 652 for the 16 year period beginning in 1958 and ending in 1974.

The average annual king salmon observed escapement for American waters of the Yukon has been 3,754 since 1972. For American and Canadian waters combined, this average has been 5,138 fish. Observed escapement for American kings in 1975 was 4,596 and for Canadian kings was 2,109. Aerial enumeration of American kings for 1975 was more comprehensive than in past years. Canadian king abundance as indicated by survey was at its highest level since 1971.

The High Seas Japanese Fisheries are believed to be, at least in part, responsible for the gradual decline in Yukon king salmon abundance. Japanese high seas gillnet catches of Bering Sea chinook have averaged 179,000 maturing fish annually since 1960. Many of these kings are believed to have been of Kuskokwim and Yukon River origin. Data recently made available, suggests that incidental catches of kings by foreign high seas bottom trawls may also be substantial.

A comparison was made of size composition for fishwheel king salmon catches in 1975 to size composition for all other king salmon measured in 1975. This comparison showed that fishwheels were highly selective for the smaller fish.

Preliminary figures on the chum commercial harvest for Alaska and Canada show a total of 987,360 summer and fall fish landed in 1975. Commercial catches for this species have averaged 257,000 a year for the period 1960-1975 (594,340 for period 71-75). A record total of 743,732 summer chum were included in chum taken commercially in the Yukon area. Seventy-five percent of the catch was made in lower Yukon subdistricts 1 and 2. For Alaskan waters, a fall commercial chum harvest of approximately 244,833 was recorded. Record commercial chum catches for 1974 and 1975 reflect very high run levels, increased commercial effort, and a generally decreased level of subsistence catches from historical levels.

In 1974 and again in 1975, chum salmon subsistence catches of 291,102 and 278,924 respectively have exceeded the previous 5 year average (1969-1973 of 222,330). Subsistence effort and catches in recent years have been generally down from historical levels.

Escapement documentation of the major Yukon spawning streams was poor prior to 1970. The 1975 chum salmon escapement of 2,151,880 was easily the high documented escapement for the Yukon. The total run index for 1975 (commercial catch, plus subsistence catch, plus escapement) was a record documented high of 3,418,160 fish. Annual observed chum escapement and total run index since 1971 have averaged respectively 704,020 and 1,520,700 fish.

The 1975 record expanded Anvik tower count of summer chums was 601,868, almost three times the 1974 count. The 1974 Anvik count was the previous historical high escapement for any stream in the Yukon system.

The top six Yukon summer chum streams for 1974: the Anvik, Andreafsky West, Nulato North and South Forks, Gisasa, and Rodo Rivers all recorded historically high observed escapements in 1975. Survey conditions for the Andreafsky East, third in escapement in 1975, were poor in 1974. Of the combined Yukon summer chum observed escapement for the top ten producing systems in 1974 and 1975, the Anvik system accounted for 54% and the Andreafsky system 27%.

The top three fall chum streams all had record escapements in 1975. Escapement enumeration of chum salmon by the Fishing Branch weir was an all-time high of 353,300 fish. The Sheenjek and Toklat Rivers had record levels of escapement during 1975 - 78,000 chums each. These three streams

have accounted for 90% of all fall chum observed escapement for the years 1974 and 1975.

Unfortunately, no good overall escapement data exists for the 1971 Yukon summer chum brood year which gave rise to the 1975 record return. The limited aerial survey data available indicates escapements in 1971 to have been generally good for Yukon summer chums. Based on a total utilization of 519,000 fish, the 1971 parent year was apparently strong (yearly average utilization 1960 - 1974 was 465,000).

Overall, there was no significant difference in the numbers of male and female chum in 1975 samples although for some individual samples, as the Sheenjek fall chum sample, significant sex differences occurred.

For the Yukon River as a whole for combined sampling methods, 87.9% of 4,261 chum salmon aged during 1975 were 4_1's. Age class 3_1 represented 6.9% of escapement and age class 5_1 represented 5.2% of escapement.

Anvik River chums averaged 565 mm mid-eye to fork of tail in 1974 and 553 mm mid-eye to fork of tail for 1975 - a statistically significant difference. No length difference was detected between the 1975 and 1973 runs. In 1975 Anvik River female chum averaged 534 mm and males 574 mm for a highly significant difference. No real length difference was noted for Emmonak summer chum when 1974 and 1975 data was compared. A highly significant difference in length was found for Anvik 1975 (553 mm) and Sheenjek 1975 (590 mm) chums. No size difference was found for Sheenjek 75 and Delta 75 fish (respectively 590 and 591 mm in length mid-eye to fork of tail).

Coho are generally of minor importance in Yukon River commercial catches and are taken incidentally to the more abundant fall chum. The 1975 commercial fishery in the lower Yukon was closed in mid-August with the filling of chum quotas. At this time the coho run was just beginning. A total commercial coho harvest of 2,340 was recorded (previous 5-year average 20,029). Coho salmon escapement documentation is still essentially in the developmental stage. Escapements, as indicated by surveys of the Clearwater Lake and Delta Clearwater systems, appeared excellent. A total of 10,730 coho were documented on the spawning grounds in 1975.

Escapement documentation for pink salmon has been poor. The Anvik River expanded total count for this species was 1,266 in 1975. A record total escapement of 50,960 pink salmon was documented during aerial surveys of the Andreafsky system in July of 1975.

RECOMMENDATIONS

Due to the site change, the sheer magnitude of the Anvik chum runs, and the lack of substantial base data for expansion techniques (expansion for counts currently in use based on 1973 data only), it is recommended that 24 hour counts be made during additional field seasons. Counting shifts should be no longer than 2 hours per observer. Conditions permitting, attempts should be made to assess the magnitude of chum and king escapements in the Yellow River during 1976.

Faced with funding limitations, it is recommended that aerial surveys be concentrated on major summer chum, king, and fall chum streams. A number of streams currently included in surveys could be deleted with little effect on total escapement counts. In view of budgetary considerations, exploratory flying will likely have to be reduced during 1976. More effort should go into interviewing persons with local knowledge of areas to be surveyed, possibly saving fruitless flights. Funding permitting, selected upper Yukon streams such as the Sheenjek should be surveyed in late July for possible occurrence of kings and summer chums.

More effort should be exerted towards the examination of king salmon carcasses in major spawning streams following die-off in August. Sex, length and age data is currently collected largely from commercial catches which are quite possibly biased samples. Size selectivity by fishwheels has been demonstrated statistically. The only major king salmon stream currently adequately sampled is the Salcha River.

Management personnel have emphasized the need for a major Yukon or Tanana fall chum tagging project aimed at stock identification. Funds do not currently exist for an undertaking of this magnitude. Other sources of additional funds are being explored and plans will be drawn up for tagging programs of various scopes. (See Appendix Table 26 for summary of historical Yukon tagging programs.)

In the event that additional funds are not forthcoming, it is recommended that an intensive documentation of a major fall spawning stream be undertaken. The logical choice would be the Sheenjek River. With the termination of the Fishing Branch study by the Canadians, no actual enumeration of a major producing fall stream will exist. It is suggested that a counting tower project be initiated on the Sheenjek to enumerate fall chum escapement and collect basic life history data.

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APPENDIX

Appendix Table 1. Vessel license registration and dollar value estimates of the Yukon district commercial fishery, 1965-1975. 1/

Year	No. Licensed Fishing Vessels 2/	Gross value to fishermen	Wholesale value of pack
1965	487	$542,300	$1,412,700
1966	517	454,500	1,308,100
1967	549	606,400	1,864,800
1968	512	535,000	1,655,156
1969	503	519,200	1,976,179
1970	549	623,100	2,113,100
1971	634	783,000	2,106,600
1972	661	784,000	2,405,200
1973	740	1,217,000	4,453,900
1974	771	1,921,000	6,035,900
1975	988	1,793,900	4,939,700

1/ Data from files - AYK Regional Office - Annual Management Reports.

2/ Number of fishing vessels is believed to be the best expression of fishing effort.

Appendix Table 2. Yukon River comparative chum salmon data [11]

Year	Total [1] Catch	Subsistence [1] Catch	Commercial [2] Catch	Licensed Fishing Vessels	Numbers of Commercial Fishing Vessels [3] Actual Fishing		Nos. of [4] Vessels		Hours Open to Comm Fishing		Test Fishing [7] catch/hours	Escapement index	
					King Salmon [5] Season	Fall [6] Season	King Salmon [5] Season	Fall [6] Season			Summer chums	Summer Chums [8]	Fall chums [9]
1961	458,744	412,889	45,855	322	10/	10/	10/	384			10/	4,631	10/
1962	412,537	358,441	54,096	447	10/	10/	10/	504			10/	14,833	10/
1963	423,817	421,625	2,192	385	10/	10/	10/	432			10/	10/	10/
1964	495,897	485,621	10,276	415	10/	10/	10/	408			10/	12,810	10/
1965	484,319	458,931	25,388	433	10/	10/	10/	10/			10/	51,188	10/
1966	288,813	214,611	74,202	478	10/	10/	10/	672			10/	20,866	10/
1967	341,373	288,577	52,796	507	10/	10/	264	504			1.30	116,000	10/
1968	257,437	189,607	67,830	464	10/	10/	588	528			0.30	31,997	10/
1969	407,893	213,754	194,139	454	10/	10/	492	600			4.18	139,250	10/
1970	572,408	223,205	349,203	492	10/	10/	468	984			2.92	108,250	10/
1971	505,813	214,368	291,445	561	559	352	456	768			1.85	84,920	275,000
1972	431,478	141,102	290,376	579	579	428	504	1,428			0.83	104,297	11,684
1973	706,439	186,176	520,263	625	605	628	696	1,620			2.82	46,263	6,954
1974	1,173,355	291,102	882,253	619	550	443	768	876			4.14	83,371	15,306
1975	1,266,283	278,924	987,359	708	590	613	612	912			4.21	328,124	102,864

1/ Catches from entire Yukon River drainage including Canada. (Mostly chum salmon, but includes small numbers of pink and coho salmon).
2/ Catches from entire Yukon River drainage including Canada. Catches 1961-1972 were primarily fall chums. After 1972, catch comprised of mostly summer chums.
3/ Numbers of commercial fishing vessels in lower 150 miles of river (subdistricts 1 and 2).
4/ "Actual numbers of fishing vessels" represents those vessels delivering at least once.
5/ "King salmon season" (June-early July) in lower 150 miles of river (subdistricts 1 and 2).
6/ "Fall season" (mid July-August) in lower 150 miles of river subdistricts 1 and 2).
7/ Located in south mouth; 25 fathom 5-1/2 inch set gill net operated early June-mid July.
8/ Average numbers of fish counted in four index areas: West Fork, Andreafsky River; East Fork, Andreafsky River; Anvik River, Salcha River. Does not include counts made during "poor" aerial survey conditions.
9/ Average numbers of fish counted in eight index areas: Toklat River, Delta River, Tanana River, Benchmark #735 slough, Bluff Cabin Slough. Delta Clearwater slough, Sheenjek River and Fishing Branch River.
10/ Information not available.
11/ Data from ADF&G, AYK Region, 1975 Salmon Fishery Report.

Appendix Table 3. Aerial survey escapement estimates, [1]/ Yukon River drainage, 1975.

Stream (drainage)	Date	Survey Rating	Kings	Cohos	Pinks	Summer Chums	Fall Chums
Archuelinguk River	7/26-27	good-fair	25	-	765	3,440	-
Andreafsky River							
West Fork	7/22	poor-good	421	-	25,540	235,954	-
East Fork	7/22-26	poor-good	993	-	25,400	223,485	-
Subtotal			1,414	-	50,940	459,439	-
Bonasila River drainage							
Stuyahok River	7/28	poor	-	-	-	6,040	-
Anvik River drainage							
Anvik River Tower Count	7/6-27		548	-	1,366	(601,868)[8]/	-
Anvik River Boat survey below tower			172	-	-	-	-
Anvik River	7/23-9/22	poor-fair	(218)[8]/	11	-	752,825	-
Beaver Creek	7/23-9/22	fair-good	(10)	257	-	19,005	-
Otter Creek	7/23-9/22	fair	(1)	2	-	47,645	-
McDonald Creek	7/23	fair	-	-	-	4,465	-
Swift River	7/23-9/22	poor-fair	(3)	197	-	21,545	-
Subtotal			720	467	1,366	845,485	-
Innoko River drainage							
Dishna River	8/1	poor	1	-	-	2,047	-
Tolstoi Creek	8/1	poor	-	-	-	491	-
Windy Creek	8/1	poor	-	-	-	1	-
Subtotal			1			2,539	
Rodo River	7/31		37	-	-	25,335	-
Kaltag River	7/31		6	-	-	4,450	-
Nulato River							
North Fork	7/24	fair	123	-	-	87,280	-
South Fork	7/24	fair	81	-	-	51,215	-
Subtotal			204			138,495	

Appendix Table 3. (Continued) Aerial Survey escapement estimates, 1/ Yukon River drainage, 1975.

Stream (drainage)	Date	Survey Rating	Kings	Cohos	Pinks	Summer Chums	Fall Chums
Koyukuk River drainage							
Gisasa River	7/24		385			56,904	-
Kateel River	7/25	fair	30	-	-	4,176	-
Box Creek	7/25	fair	-	-	-	100	-
Subtotal						4,276	
Dakli River	7/24	good	-	-	-	4,175	-
Wheeler Creek	7/24	good	-	-	-	8,675	-
Subtotal						12,850	
Hogatza River							
Caribou Creek	7/25	good	-	-	-	14,745	-
Clear Creek	7/25	good	-	-	-	7,610	-
Subtotal						22,355	
Batza Creek	7/25	-	-	-	-	372	
Alatna River	8/6	fair	2	-		396	-
Henshaw (Sozhekla)Cr.	8/6	good	118	-	-	1,219	-
South Fork Koyukuk	8/5	fair	147	-	-	14,626	-
Fish Creek							
Bonanza Creek	8/6		-	-	-	11	-
Jim River	8/6	fair	53	-	-	1,057	
Subtotal South Fork			200			15,694	
Subtotal Koyukuk River drainage			735			114,066	
Melozitna River drainage	7/29		136	-	-	8,743	-
Tozitna River	7/29		202	-	-	3,512	-
Tanana River drainage							
Kantishna River drainage							
Toklat River drainage	10/6	poor	-	-	-	-	78,285
Bear Paw River	8/2-9/29	fair	36	-	-	-	1,657
Subtotal			36				79,942

Appendix Table 3. (Continued) Aerial survey escapement estimates, [1] Yukon River drainage, 1975.

Stream (drainage)	Date	Survey Rating	Kings	Cohos	Pinks	Summer Chums	Fall Chums
Tanana River Drainage (continued)							
Nenana River	10/6	good	-	827	-	-	-
Seventeen Mile Slough	9/29	good	-	956	-	-	-
Lost Slough	9/29	good	-	116	-	-	-
Subtotal				1,899			
Chena River [2]	8/5-15		316	-	-	2,380	-
Salcha River	8/11-18	fair	1,055	-	-	7,573	-
Banner Creek [6]	10/14	poor					4
Upper Tanana River drainage							
Five Mile Clearwater	11/17	poor	-	5	-	-	-
Richardson Clearwater	11/17		-	4	-	-	-
Delta River [6]	10/7-11/30	good	-	-	-	-	3,946
Bluff Cabin Slough	10/30	poor	-	-	-	-	5,000
Clearwater Lake & outlet	11/1-7	good	-	1,575	-	-	-
Delta Clearwater Creek	11/1-7	good	-	5,100	-	-	-
Delta Clearwater Slough	10/6	poor	-	-	-	-	745
Volkmar River Slough [3]	10/5-10		-	-	-	-	100
Chisana River			-	-	-	-	-
Sheep Creek	10/27	poor	-	-	-	-	29
Subtotal Upper Tanana River				6,684		9,953	9,820
Subtotal Tanana River drainage			1,407	6,693		9,953	89,766
Chandalar River	9/27	poor	-	-	-	-	6,345
Porcupine River drainage							
Sheenjek River	10/8	fair	-	6	-	-	78,060
Black River		poor	-	-	-	-	50
Salmon Fork	10/7	poor	-	-	-	-	1,517
Salmon Trout River	9/27	poor	-	-	-	-	350
Fishing Branch River [4] [5]	9/3-10/9		-	-	-	-	353,282
Subtotal				6			433,259

Appendix Table 3. (Continued) Aerial survey escapement estimates, 1/ Yukon River drainage, 1975.

Stream (drainage)	Date	Survey Rating	Kings	Cohos	Pinks	Summer Chums	Fall Chums
Yukon Territory Streams 5/							
Tatchun Creek 6/			175	-	-	-	-
Nisutlin River	8/24	poor-fair	337	-	-	-	-
Big Salmon River	8/26		800	-	-	-	-
Morley River	8/26		30	-	-	-	-
Takhini River	8/29		165	-	-	-	-
Mitchie Creek			(39)	-	-	-	-
Wolf River	8/26		40	-	-	-	-
Kluane River	10/15			-	-	-	362
Yukon River (main stem) 6/			600	-	-	-	7,000
Whitehorse Fishway 7/			313	-	-	-	-
Subtotal			2,460				7,362
Total for Yukon River drainage			7,347	9,056	53,071	1,621,497	530,387

1/ Only peak counts listed, salmon carcasses included. From unpublished aerial survey data ADF&G, AYK Region, 1975
2/ Boat surveys by on Ross, USF & W.
3/ Aerial survey by Gary Pearse, Sport Fish Division, ADF&G.
4/ Weir count.
5/ Survey data supplied by Environment Canada-Fisheries Service, Whitehorse.
6/ Foot survey.
7/ Fishway count.
8/ Data in parenthesis not included in subtotals or totals.

Appendix Table 4. Yukon River salmon run indices 1/

KING

Year	Commercial Catch	Subsistence Catch 5/	Total Harvest	Observed Escapement 2/	Total Run Index
1971	113.69	25.19	138.88	-	138.88 4/
1972	94.61	19.59	114.20	6.11	120.31
1973	77.22	22.22	99.44	3.42	102.86
1974	100.13	20.57	120.70	4.30	125.00
1975	66.74	17.71	84.45	6.71	91.16
Total	452.39	105.28	557.67	20.54	578.21
$\bar{x}$	90.48	21.06	111.53	5.13	115.64

CHUM

1971	291.44	214.37	505.81	292.41 3/	798.22
1972	290.38	141.10	431.48	385.35 3/	816.83
1973	520.26	186.18	706.44	195.89 3/	902.33
1974	882.25	291.10	1,173.36	494.60 3/	1,667.96
1975	987.36	278.92	1,266.28	2,151.88	3,418.16
Total	2,971.69	1,111.67	4,083.37	3,520.13	7,603.50
$\bar{x}$	594.34	222.33	816.67	704.02	1,520.70

1/ In thousands of salmon. Includes Canadian catch and escapement data. Chum includes both fall and summer fish. Catch and escapement data from AYK Annual Management Reports.
2/ Sum of peak counts aerial surveys and weir counts for Anvik and weir counts Fishing Branch. Systems.
3/ Some major spawning systems not surveyed.
4/ Does not include escapement data.
5/ Mostly chum but includes small numbers of pink and coho salmon.

Appendix Table 5. Comparative Yukon River drainage summer chum salmon aerial survey escapement estimates, 1958-1975.

Year	SUMMER CHUMS			
	Andreafsky River (East Fork)	Andreafsky River (West Fork)	Anvik River	Salcha River
1958			100-200,000	
1959			200,000	
1960	3,830		11,110	670
1961	8,110			1,152
1962	18,040	19,530	20,600	1,161
1963				
1964		12,810	12-14,000 1/	250 1/
1965		14,670 1/	100,000	2,375
1966	25,619	18,145	37,500	2,200
1967		14,495 2/	116,000	
1968	17,600 2/	74,600 2/	51,580 1/	3,790
1969	119,000	159,500		425 1/
1970	84,090	91,710 1/	232,780	7,879
1971	98,095	71,745		306 1/
1972	41,460	25,573	245,857 3/	947 1/
1973	10,149 1/	51,835	86,665 3/	290
1974	3,215 1/	33,258	208,815 4/	8,040 5/
1975	223,485	235,954	815,561 6/	7,573

1/ Poor or incomplete survey.

2/ Includes some pinks.

3/ Combined tower and aerial survey estimates.

4/ Tower counts.

5/ Combined aerial and boat surveys.

6/ Includes several tributary streams.

Appendix Table 6. Yukon River comparative king salmon data.

Year	Total Catch 1/	Subsistence Catch 1/	Commercial Catch 1/	Nos. of Comm. Fishing Vessels 2/ Licensed Fishing Vessels	Actual Nos. of Fishing Vessels	Hours open to Comm. Fishing 3/	Test Fishing catch/hours 4/	Escapement Index 5/
1961	155,570	31,864	123,706	322	-6/	852	6/	1,650
1962	120,381	21,610	98,771	447	-6/	818	6/	1,218
1963	152,247	32,970	119,277	385	-6/	774	6/	484
1964	119,672	22,877	96,795	415	-6/	606	6/	652
1965	140,086	19,723	120,363	433	-6/	720	6/	655
1966	109,529	14,272	95,257	478	-6/	552	6/	507
1967	151,554	19,661	131,893	507	-6/	744	.64	533
1968	123,744	15,006	108,738	464	-6/	746	.44	476
1969	106,863	15,000	91,863	454	-6/	660	.72	334
1970	98,854	15,974	82,880	492	-6/	636	.70	1,057
1971	138,871	25,186	113,685	561	559	528	.83	1,348
1972	114,197	19,588	94,609	579	579	552	.41	794
1973	99,439	22,215	77,224	625	605	540	.67	523
1974	120,698	20,565	100,133	619	550	576	.95	805
1975	84,449	17,709	66,740	708	590	420	.28	696

1/ Catches from entire Yukon River drainage including Canada.
2/ Numbers of Commercial Fishing Vessels in lower 150 miles of river (subdistricts 1 and 2). "Actual numbers of fishing vessels" represents those vessels delivering at least once during the king salmon season.
3/ "King salmon season" (June-early July) in lower 150 miles of river (subdistricts 1 and 2).
4/ Located in south mouth; 25 fathom 8 1/2 inch set gill nets.
5/ Average numbers of fish counted in four index areas: West Fork, Andreafsky River; East Fork, Andreafsky River; Salcha River; Whitehorse fishway, does not include counts made during "poor" aerial survey conditions.
6/ Information not available.

Appendix Table 7. Western Alaska king salmon catch compared to Japanese mothership catch in the Bering Sea, 1960-1975. 1/

Year	Yukon River 2/	A-Y-K Region 3/	Total Western Alaska 4/	Japanese Mothership Bering Sea
1960	78,647	93,017	220,031	142,000
1961	155,570	201,358	295,514	10,000
1962	120,381	156,413	245,960	-
1963	152,247	209,456	279,426	42,000
1964	119,672	171,070	317,598	204,000
1965	140,086	189,888	314,086	116,000
1966	109,529	184,268	275,382	122,000
1967	151,554	243,328	370,244	70,000
1968	123,744	201,319	316,625	293,000
1969	106,863	214,606	351,860	450,000
1970	98,854	235,510	387,125	404,000
1971	138,871	229,379	359,223	157,000
1972	114,197	216,428	291,798	220,000
1973	99,439	193,069	248,872	32,000
1974	120,698	177,988	238,789	234,000
1975	84,449	161,909	196,709	200,000 5/

1/ Catch data presented in numbers of fish. Data from reports of National Marine Fisheries Service, 1975.

2/ Commercial and subsistence catch data combined (includes Canadian catches).

3/ Commercial and subsistance catch data combined.

4/ Combined commercial and subsistence catches of AYK region and Bristol Bay area plus North Alaska Peninsula commercial catches.

5/ Preliminary data.

Appendix Table 8. Comparative Yukon River drainage king salmon escapement counts 1959-1975 1/

Year	Andreafsky River (East fork)	Andreafsky River (West fork)	Anvik River
1960	1,020	1,220	1,950
1961	1,003		1,226
1962	675 2/	762 2/	
1963			
1964	867	705	
1965		355 2/	650 2/
1966	361	303	638
1967		276 2/	336 2/
1968	380	383	297 2/
1969	231 2/	274 2/	296 2/
1970	665	574 2/	368 2/
1971	1,904	1,284	
1972	798	582 2/	1,172 4/
1973	825	788	613 4/
1974		285	471 5/
1975	993	421	730 6/

Year	Salcha River	Nisutlin River (Sidney-100 mile cr.)	Whitehorse Dam Fishway
1959			1,054
1960	1,660		660
1961	2,878		1,068
1962	937		1,500
1963			484
1964	450		587
1965	408		903
1966	800		563
1967			533
1968	735	407	407
1969	461 2/	105	334
1970	1,882	615	625
1971	159 2/	640 3/	856
1972	1,193	317	392
1973	249	36 2/	228
1974	1,857	48 2/	273
1975	1,055	249	313

1/ With the below exceptions the data was obtained from aerial surveys which were made only of the main stem of each river listed

2/ Incomplete survey or poor survey conditions resulting in a very minimal count.

3/ Environment Canada - Fisheries Service survey.

4/ Combination tower counts and aerial survey estimates.

5/ Tower count.

6/ Combination tower and boat counts.

Appendix Table 9. Yukon River drainage observed peak coho salmon escapement estimates by year.

Stream Location	1975	1974	1973	1972	1971
Anvik	467				
Tanana		22			
Nenana					
Clearwater Slough 1 mile below Anderson	700	900			
5 mile below Clear Air Force Base	900	827			
Lost Slough	116				
Seventeen Mile Creek	956				
Benchmark	735	86			
Delta Clearwater	5,400	3,950	1,982	632	3,000
Clearwater Lake and outlet	1,450	12			
Richardson Clearwater		235			
Blue Creek		64			
Sheenjek	6				
Fishing Branch		8			

Appendix Table 10. Yukon River comparative chinook and chum salmon catch data for Flat Island test fishery. 1/ 2/

Year	Catch per gillnet hour	
	King Salmon	Chum Salmon
1967	0.64	1.30
1968	0.44	0.30
1969	0.72	4.18
1970	0.70	2.92
1971	0.83	1.85
1972	0.41	0.83
1973	0.67	2.82
1974	0.95	4.14
1975	0.30	4.21
Average 1967-74	0.67	2.29

1/ Index gear: king salmon - two 25 fathom 8 1/2" set gillnets, chum salmon - one 25 fathom 5 1/2" set gillnet.

2/ Schneiderhan, D.J., 1976. Flat Island Test Fishing Study, 1975. AYK Region Data Report No. 14.

Appendix Table 11. Cumulative daily Whitehorse fishway king salmon counts, 1965-1975.

Date	1965	1966	1967 2/	1968	1969 1/	1970	1971	1972	1973	1974 3/	1975
/1	5	4	38	4						18	
2	9	10	53	5	8	1			1	31	
3	16	24	67	11	16	4			2	36	
4	30	40	87	18	28	5		1	3	43	
5	49	54	106	43	43	6		3	3	57	
6	58	74	121	70	99	12		9	8	70	
7	93	97	136	107	118	18	3	20	20	79	
8	124	120	172	152	149	24	5	24	24	94	
9	150	136	196	173	181	47	7	31	29	103	15
10	197	188	233	173	187	77	10	33	41	115	26
11	282	214	263	174	210	108	27	47	50	123	47
12	382	248	306	180	239	6	36	61	56	149	55
13	510	304	344	205	260	202	60	105	64	189	66
14	542	357	397	239	273	284	87	139	84	199	78
15	583	388	417	267	297	313	127	184	97	211	100
16	630	427	429	290	316	346	195	233	110	231	122
17	670	478	454	339	322	415	287	269	120	243	138
18	688	500	478	359	324	436	358	293	130	258	169
'	728	518	494	363	324	511	447	300	150	260	184
20	785	532	506	369	324	560	493	316	167	265	197
21	817	536	516	376	328	576	534	347	187	267	214
'	843	548	520	389	328	595	607	355	203	270	239
3	864	554	526	392	328	610	643	369	211	270	254
'	883	557	530	405	328	617	683	382	214	271	280
25	893	560	532	405	331	622	727	386	220	271	298
26	898	562	532	405	334	624	762	386	220	273	307
27	902	562	533	405		625	788	388	224		311
28	903	562		405			812	392	224		0
29		563		406			835		224		313
30				406			841		227		
31				406			842		228		
9/1				406			849				
2				407			855				
3							856				
4											
5											
otals	(903)	(563)	(533)	(407)	(334)	(625)	(856)	(392)	(228)	(273)	(313)

/ First fish on 7/23

2/ First fish on 7/25

' First fish on 7/26

Appendix Table 12. Comparative Yukon River drainage survey estimates of fall chum salmon 1971-1975. 1/

	1971	1972	1973	1974	1975
Tanana River drainage					
Bear Paw River		2/	1,530	2,996	1,657
Toklat River		1,000 3/	6,957	34,310	78,285 3/ 8/
Benchmark 735 slough		5,255	127 4/	1,450	2/
Delta River		3,650	7,971	4,010	3,946 9/
Tanana River 7/		8,350	5,635	4,567	2/
Bluff Cabin slough		6,040	3,450	4,840	5,000 3/
Delta Clearwater slough		2/	1,720 3/	1,235	745
Chandalar River		2/	5/	17,455	6,345 3/
Porcupine River drainage					
Sheenjek River		2/	1,175 3/	40,507	78,060
Fishing Branch River	250-300,000	35,126 6/	15,989 6/	31,525 6/	353,282 6/

1/ All surveys rated fair - good unless rated otherwise

2/ Not surveyed.

3/ Poor survey.

4/ Surveyed too early.

5/ Surveyed too late.

6/ Weir count.

7/ Richardson Highway Bridge to Blue Creek.

8/ Surveyed entire river

9/ Foot survey.

Appendix

Table 13. Percent escapement of top ten known Yukon chum spawning streams accounted for by the two most productive summer systems and three most productive fall systems for 1974 and 1975. 1/

Summer Chum System

Year	Yukon River Total	Anvik River No.	Anvik River %	Andreafsky River No.	Andreafsky River %	Total No.	Total %
1975	1,531	813	53.1	459	30.0	1,272	83.0
1974	340	201	59.1	37	10.9	238	70.0
Total	1,871	1,014	54.2	496	26.5	1,510	80.7

1/ In thousands of salmon.

Fall Chum System

Year	Yukon River Total	Sheenjek No.	Sheenjek %	Toklat No.	Toklat %	Fishing Branch No.	Fishing Branch %	Total No.	Total %
1975	536	78	15	78	15	353	66	509	95
1974	149	41	28	34	23	33	22	108	72
Total	685	119	17	112	16	386	57	617	90

1/ In thousands of salmon.

Appendix Table 14 . Daily water temperatures - Anvik River, 1973-1975.

Date	Year - Water temperature °F 1975	1974	1973
June 16		51	
17		51	
18		52	
19		44	
20		56	
21		58	
22		58	
23		60	
24	43	56	
25	43	56	
26	44	58	-
27	47	-	61
28	46	60	59
29	49	62	56
30	44	62	58
July 1	43	61	59
2	43	65	62
3	45	64	59
4	50	66	59
5	55	64	59
6	50	-	56
7	55	60	50
8	50	58	50
9	50	60	51
10	54	57	56
11	54	-	56
12	59	54	54
13	58	56	54
14	53	60	55
15	55	60	59
16	54	56	59
17	50	52	54
18	52	52	51
19	62	52	54
20	57	52	55
21	54	52	55
22	61		54
23	61		53
24	58		50
25	57		55
26	58		50
27	52		55
28			51
29			51
30			

$C = 5/9 (F - 32)$

$F = (9/5\ C) + 32$

Appendix Table 15. King Salmon hourly enumeration log net counts-Anvik River, 1975

Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
7-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
7-7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
7-8	-	-	6	-	-	1	1	-	-	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-	11
7-9	-	2	-	-	1	4	-	-	-	-	-	-	-	1	4	-	6	2	-	-	-	-	2	-	22
7-10	-	-	-	-	-	-	1	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	2	2	10
7-11	-	-	-	1	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	2	-	-	-	6
7-12	-	-	-	-	-	4	-	-	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	-	7
7-13	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	1	-	5	2	-	1	-	12
7-14	-	-	-	-	-	3	2	-	1	3	1	1	2	-	-	2	-	1	1	-	-	-	-	-	17
7-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
7-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
7-17	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	1	-	3
7-18	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	1	-	3	1	1	3	-	13
7-19	-	-	-	-	-	-	-	-	-	1	-	-	2	1	-	1	-	-	1	1	-	1	-	-	8
7-20	-	-	-	-	-	-	2	-	-	-	-	-	-	2	1	-	-	-	-	-	-	1	1	-	7
7-21	-	-	-	-	-	-	-	-	-	-	-	-	-	8	1	-	7	1	-	-	1	-	-	-	18
7-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	2	-	-	-	-	-	-	5
7-23	-	-	-	-	-	-	-	-	-	-	-	-	-	4	9	-	8	1	-	-	1	-	-	-	23
7-24	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-	1	-	-	1	-	-	-	1	6
7-25	-	-	-	-	-	-	-	-	-	-	-	-	-	1	12	-	5	2	-	-	-	-	1	2	23
7-26	-	-	-	-	-	-	-	-	-	-	-	-	-	1	7	-	2	4	-	-	-	-	-	-	14
7-27	-	-	-	-	-	-	-	-	-	-	-	-	-	4	10	-	7	3	-	3	1	-	-	-	28
7-28	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	5	2	5	-	2	1	-	-	18
7-29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	5	-	-	2	-	-	-	11
Total	0	2	6	1	2	12	7	-	1	4	1	1	4	32	52	8	49	25	9	14	13	4	12	5	264

Appendix Table 16 King Salmon hourly enumeration log estimated daily and total expanded counts, Anvik River, 1975 [1/] [2/]

Date	HOUR 00	01	02	03	04	05	06	13	14	15	16	17	18	19	20	21	22	23	Actual Total	[3/] Hours Counted	18 Hour Expansion [9/] Factor		Expanded 18 Hour Total	[9/][10/] 24 Hour Expansion Factor	Expanded [3/][9/] 24 Hour Total
7-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	18	1		1	1.27	1
7-8	0	0	6	0	0	1	1	0	0	1	1	0	0	0	1	0	0	0	11	18	1		11	1.27	14
7-9	0	2	0	0	1	4	0	1	4	0	6	2	0	0	0	0	2	0	22	18	1		22	1.27	28
7-10	0	0	0	0	0	0	1	3	0	2	0	0	0	0	0	0	2	2	10	18	1		10	1.27	13
7-11	0	0	0	1	1	0	0	1	0	0	0	0	0	1	2	0	0	0	6	18	1		6	1.27	8
7-12	0	0	0	0	0	4	0	1	0	1	1	0	0	0	0	0	0	0	7	18	1		7	1.27	9
7-13	0	0	0	0	0	0	0	1	1	1	0	1	0	5	2	0	1	0	12	18	1		12	1.27	15
Sub-Total	0	2	6	1	2	9	2	7	5	5	8	3	0	6	5	0	6	2	69	126	1		69	1.27	88
Sub-Total Percent	0	2.90	8.7	1.45	2.90	13.04	2.90	10.14	7.46	7.46	11.59	4.35	0	8.70	7.46	0	8.70	2.90	100	75	Factor 1	Factor 2			
7-6	(-)	(-)	(-)	(-)	(-)	(-)	(-)	0	0	0	0	0	1	0	0	0	0	0	1	11		(1.45)	1	1.27	2
7-14	0	0	0	0	0	3	2	0	0	2	0	1	1	0	(1)	(0)	(1)	(-)	9	13	1.33	(1.22)	15	1.27	17
7-15	(0)	(-)	(1)	(-)	(-)	(2)	(-)	(1)	(1)	(1)	(1)	(1)	(0)	(1)	(1)	(0)	(1)	(-)		0	7/14+7/17÷2		12	1.27	14 [4/]
7-16	(0)	(-)	(1)	(-)	(-)	(2)	(-)	(1)	(1)	(1)	(1)	(1)	(0)	(1)	(1)	(0)	(1)	(-)		0	7/14+7/17÷2		12	1.27	14 [4/]
7-17	(0)	(-)	(1)	(-)	(-)	(1)	(-)	1	0	0	0	0	1	0	0	0	1	(-)	3	10	2.00	(1.52)	9	1.27	11 [5/]
7-18	(0)	(1)	(3)	(-)	(1)	(4)	(1)	2	2	0	0	1	0	3	1	1	3	(-)	13	10	1.54	(1.52)	30	1.27	38 [6/]
7-19	(0)	(-)	(1)	(-)	(-)	(2)	0	1	(1)	1	0	(1)	1	1	(1)	1	0	(-)	5	8	1.23	(2.02)	12	1.27	16 [7/]
7-20	(0)	(-)	(1)	(-)	(-)	(2)	(-)	2	1	(1)	(2)	2	(0)	0	0	1	1	0	7	6.67		(2.01)	14	1.27	18 [8/]
7-21	(0)	(1)	(2)	(-)	(1)	(4)	0	8	1	(2)	7	1	(0)	0	1	(0)	0	0	18	9		(1.56)	28	1.27	36
7-22	(0)	(-)	(1)	(-)	(-)	(1)	0	0	1	(1)	2	2	(0)	0	0	(0)	0	0	5	9		1.56	8	1.27	10
7-23	(0)	(1)	(3)	(1)	(1)	(5)	0	4	9	(3)	8	1	(0)	0	1	(0)	0	0	23	9		1.56	36	1.27	46
7-24	(0)	(-)	(1)	(-)	(-)	(1)	1	0	2	(1)	1	0	(0)	1	0	(0)	0	1	6	9		1.56	9	1.27	11
7-25	(0)	(1)	(3)	(1)	(1)	(5)	0	1	12	(3)	5	2	(0)	0	0	(0)	1	2	23	9		1.56	36	1.27	46
7-26	(0)	(1)	(2)	(-)	(1)	(3)	0	1	7	(2)	2	4	(0)	0	0	(0)	0	0	14	8.5		1.56	22	1.27	28
7-27	(0)	(2)	(5)	(1)	(2)	(7)	(2)	4	10	(4)	7	3	(0)	3	1	(0)	0	0	28	7.5		1.95	55	1.27	70
7-28	(0)	(1)	(3)	(1)	(1)	(4)	(1)	1	2	0	5	2	5	0	2	1	(3)	(1)	18	9		1.75	32	1.27	40
7-29	(0)	(1)	(3)	(1)	(1)	(4)	(1)	(3)	(3)	(3)	4	5	0	0	2	0	(3)	(1)	11	6		3.12	34	1.27	43
Actual Grand Total	0	2	6	1	2	12	5	32	52	8	49	27	9	14	13	4	12	5	253	134.67			434	1.27	548
Actual Percent	0	0.79	2.37	0.40	0.79	4.74	1.98	12.65	20.55	3.16	19.37	10.67	3.56	5.53	5.14	1.58	4.74	1.98	100	33.01			79.20		
Expanded 18 Hour Total	0	11	37	6	11	59	10	37	58	30	53	30	9	16	17	4	21	7					416		
Expanded Percent	0	2.64	8.89	1.44	2.64	14.18	2.40	8.89	13.94	7.21	12.74	7.21	2.16	3.85	4.87	0.96	5.05	1.68							

1/ Net Counts: Upstream migrants minus downstream migrants. Hours 07 through 1200 not included.
2/ Estimated daily counts in parenthesis. Based on days 7-7 through 7-13.
3/ Expanded by: (1) Factor for water and/or other conditions lowering count, (2) Factor representing hours of missing counts, (3) percent movement found during hours 0700 through 1300 in 1973-27%.
4/ Average of Count 7/14 and 7/17.
5/ Estimate water conditions only permitted 50% count this day: See field data, expanded by 2.
6/ Estimate water conditions only permitted partial count this day: See field data, expand by 1.54.
7/ Sampling scheme involved expansion of counts by 1.23. See field data.
8/ On this date hours 20 and 22 only partial count: Percentage thus adjusted. See field data.
9/ Calculations and totals subject to rounding error.
10/ Hour counts may not sum to give 18 hour totals. Must be expanded as indicated by computation factor and field data.

Appendix Table 17 Chum salmon hourly enumeration log net counts, Anvik River, 1975[1/]

Date	HOUR 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOTAL
7-6														91	169	117	98	197	217	440	528	941	949	1,145	4,89
7-7	931	984	979	1,118	967	758	507	-	-	-	-	-	-	499	549	1,089	659	619	502	708	494	890	980	1,093	14,32
7-8	1,095	1,402	1,531	1,117	1,278	1,245	692	-	-	-	-	-	-	359	448	533	300	803	494	669	747	1,112	790	1,014	15,62
7-9	1,106	1,242	1,744	1,957	2,510	1,903	2,382	-	-	-	-	-	-	1,267	1,205	1,251	1,427	1,858	3,882	2,968	2,504	2,781	2,719	2,834	37,54
7-10	2,678	2,289	3,416	3,640	3,331	3,322	2,637	-	-	-	-	-	-	2,480	2,291	2,799	1,724	1,235	930	1,010	1,722	1,832	2,755	2,687	42,77
7-11	1,898	1,643	700	1,204	1,456	2,009	1,924	-	-	-	-	-	-	1,576	1,394	944	1,390	1,559	1,401	1,476	2,390	4,154	2,030	1,285	30,43
7-12	2,328	2,414	2,387	2,960	3,020	3,209	3,111		-	-	-	-	-	1,473	1,586	1,352	1,560	2,098	2,333	2,107	2,274	2,669	2,763	2,251	41,69
7-13	2,385	2,330	2,982	3,368	2,587	2,840	1,901	-	-	-	-	-	-	2,151	2,452	2,296	2,860	1,642	2,569	2,681	2,532	2,672	2,831	2,516	45,59
7-14	2,883	3,241	2,793	2,566	3,187	4,369	2,867	3,235	3,681	3,711	3,445	3,908	3,633	1,918	1,601	1,365	1,278	1,059	1,412	-	-	-	-	-	51,75
7-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7-17	-	-	-	-	-	-	-	-	-	-	-	-	-	377	235	807	682	861	777	1,110	1,140	848	1,230	-	8,067
7-18	-	-	-	-	-	-	-	-	-	-	-	-	-	225	585	333	232	1,185	997	636	1,656	1,781	901	-	8,531
7-19	-	-	-	-	-	-	71	98	-	845	415	-	189	762	-	775	700	-	547	1,099	-	1,332	634	-	7,467
7-20	-	-	-	-	-	-	-	-	-	-	-	-	-	561	626	-	-	550	-	143	845	522	872	713	4,832
7-21	-	-	-	-	-	-	308	-	-	-	-	-	-	431	536	-	485	644	-	561	472	-	856	894	5,187
7-22	-	-	-	-	-	-	184	-	-	-	-	-	-	201	274	-	295	276	-	369	416	-	620	654	3,289
7-23	-	-	-	-	-	-	131	-	-	-	-	-	-	132	208	-	274	272	-	342	340	-	667	516	2,882
7-24	-	-	-	-	-	-	204	-	-	-	-	-	-	142	156	-	211	181	-	220	167	-	386	337	2,004
7-25	-	-	-	-	-	-	116	-	-	-	-	-	-	100	80	-	79	120	-	100	161	-	276	224	1,256
7-26	-	-	-	-	-	-	48	-	-	-	-	-	-	69	80	-	83	143	-	93	136	-	158	68	878
7-27	-	-	-	-	-	-	-	-	-	-	-	-	-	46	45	-	58	58	-	91	56	-	53	50	457
Total:	15,304	15,545	16,532	17,930	18,336	19,660	17,083	3,333	3,681	4,556	3,860	3,908	3,827	14,460	14,520	13,661	14,395	15,360	16,061	16,823	18,580	21,534	22,470	18,231	329,700

1/ Net Counts: upstream migrants minus downstream migrants.

Appendix Table 18 Chum salmon hourly enumeration log-estimated daily and total expanded counts, Anvik River, 1975[1/2/]

Date	HOUR 00	01	02	03	04	05	06	13	14	15	16	17	18	19	20	21	22	23	Actual Total	Hours Counted	18 Hour Expansion Factor [9/]		Expanded 18 Hour Total [9/] [10/]	24 Hour Expansion Factor	24 Hour Expanded Total [3/] [9/]
Complete Daily Counts																									
7-7	931	924	979	1,118	967	758	507	499	549	1,089	659	619	502	708	494	890	980	1,093	14,326	18	1		14,326	1.19	17,048
7-8	1,035	1,402	1,531	1,117	1,278	1,245	692	359	448	533	300	803	494	669	747	1,112	790	1,014	15,629	18	1		15,629	1.19	18,589
7-9	1,136	1,242	1,744	1,937	2,510	1,908	2,382	1,267	1,205	1,251	1,427	1,858	3,882	2,968	2,504	2,781	2,719	2,834	37,545	18	1		37,545	1.19	44,679
7-10	2,673	2,289	3,415	3,640	3,331	3,322	2,637	2,480	2,291	2,799	1,724	1,235	930	1,010	1,722	1,832	2,755	2,687	42,778	18	1		42,778	1.19	50,906
7-11	1,893	1,543	700	1,204	1,456	2,009	1,924	1,576	1,394	944	1,390	1,559	1,401	1,476	2,390	4,154	2,030	1,285	30,433	18	1		30,433	1.19	36,215
7-12	2,328	2,414	2,387	2,960	3,020	3,209	3,111	1,473	1,586	1,352	1,560	2,098	2,333	2,107	2,274	2,669	2,763	2,251	41,895	18	1		41,895	1.19	49,855
7-13	2,385	2,330	2,982	3,368	2,587	2,840	1,901	2,151	2,452	2,296	2,860	1,642	2,569	2,681	2,532	2,672	2,831	2,516	45,595	18	1		45,595	1.19	54,258
Subtotal:	12,421	12,304	13,739	15,364	15,149	15,291	13,154	9,805	9,925	10,264	9,920	9,814	12,111	11,619	12,663	16,110	14,868	13,680	228,201	126	1		228,201	1.19	271,562
Subtotal Percent:	5.4	5.4	6.0	6.7	6.6	6.7	5.8	4.3	4.3	4.5	4.3	4.3	5.3	5.1	5.5	7.1	6.5	6.0		75	Factor 1	Factor 2			
Incomplete Daily Counts																									
7-6	(460)	(450)	(511)	(571)	(563)	(571)	(496)	91	169	117	98	197	217	440	528	941	949	1,145	4,892	11		1.74	8,523	1.19	10,142
7-14	2,833	3,241	2,793	2,566	3,187	4,369	2,867	1,518	1,601	1,365	1,278	1,059	1,412	(2,923)	(3,153)	(4,070)	(3,726)	(3,439)	30,139	13	1.33	1.43	57,322	1.19	68,213
7-15	(2,385)	(2,385)	(2,661)	(2,972)	(2,927)	(2,972)	(2,573)	(1,907)	(1,907)	(1,996)	(1,907)	(1,907)	(2,361)	(2,262)	(2,440)	(3,149)	(2,883)	(2,661)		0	7/14+7/17:2		44,356	1.19	52,784 [4/]
7-16	(2,385)	(2,385)	(2,661)	(2,972)	(2,927)	(2,972)	(2,573)	(1,907)	(1,907)	(1,996)	(1,907)	(1,907)	(2,361)	(2,262)	(2,440)	(3,149)	(2,883)	(2,661)		0	7/14+7/17:2		44,356	1.19	52,784 [4/]
7-17	(1,695)	(1,695)	(1,883)	(2,103)	(2,072)	(2,103)	(1,821)	377	235	807	682	861	777	1,110	1,140	846	1,230	(1,883)	8,067	10	2.00	1.95	31,390	1.19	37,354 [5/]
7-18	(1,330)	(1,330)	(1,534)	(1,712)	(1,687)	(1,712)	(1,482)	225	585	333	232	1,185	997	636	1,656	1,781	901	(1,534)	8,531	10	1.54	1.95	25,569	1.19	30,415 [6/]
7-19	(917)	(917)	(1,018)	(1,137)	(1,120)	(1,130)	71	762	(730)	775	700	(730)	547	1,099	(934)	1,332	634	(1,018)	5,920	8	1.23	1.95	16,574	1.19	20,199 [7/]
7-20	(760)	(760)	(845)	(943)	(929)	(943)	(814)	561	626	(634)	(605)	550	(746)	858	845	1,044	872	713	6,069	6.67		2.33	14,030	1.19	16,755 [8/]
7-21	(603)	(603)	(673)	(761)	(743)	(761)	308	431	536	(506)	485	644	(596)	561	472	(799)	856	894	5,187	9		2.32	11,252	1.19	13,390
7-22	(385)	(385)	(428)	(478)	(471)	(478)	184	201	274	(321)	295	276	(378)	369	416	(507)	620	654	3,289	9		2.16	7,134	1.19	8,489
7-23	(338)	(338)	(375)	(419)	(413)	(413)	131	132	208	(281)	274	272	(331)	342	340	(444)	667	516	2,862	9		2.16	6,252	1.19	7,440
7-24	(236)	(236)	(261)	(291)	(287)	(291)	204	142	156	(196)	211	181	(230)	220	167	(309)	386	337	2,004	9		2.16	4,347	1.19	5,173
7-25	(147)	(147)	(164)	(183)	(180)	(183)	116	100	80	(123)	79	120	(144)	100	161	(194)	276	224	1,256	9		2.16	2,725	1.19	3,243
7-26	(103)	(103)	(114)	128	(125)	(128)	48	69	80	(86)	33	143	(101)	93	136	135	158	136	878	8.5		2.16	2,043	1.19	2,431
7-27	(67)	(67)	(75)	(84)	(83)	(84)	(73)	46	45	(57)	58	58	(67)	91	56	(89)	53	100	457	7.5		2.48	1,257	1.19	1,496
Actual Grand Total:	15,304	15,545	16,532	17,930	18,336	19,660	17,083	14,460	14,520	13,661	14,395	15,360	16,061	17,538	18,580	22,056	22,470	18,399	306,535	121.67 34			505,771	1.19	601,868
Actual Percent:	5.0	5.1	5.4	5.8	6.0	6.4	5.6	4.7	4.7	4.4	4.7	5.0	5.2	5.7	6.1	7.2	7.3	6.0							
Expanded 18 Hour Total:	27,190	27,431	29,737	32,604	32,863	34,401	26,913	18,274	19,364	19,857	18,764	19,904	23,356	24,985	27,547	34,901	31,964	31,595							
Expanded Percent:	5.4	5.4	5.9	6.5	6.5	6.8	5.3	3.6	3.8	3.9	3.7	3.9	4.6	4.9	5.4	7.0	6.3	6.2							

1/ Net Counts: Upstream migrants minus downstream migrants. Hours 07 through 1200 not included.
2/ Estimated daily counts in parenthesis. Based on days 7-7 through 7-11.
3/ Expanded by: (1) Factor for water and/or other conditions lowering count, (2) Factor representing hours of missing counts, (3) percent movement found during hours 0700 through 1300 in 1973.
4/ Average of Count 7/14 and 7/17.
5/ Estimate water conditions only permitted 50% count this day: See field data, Expanded by 2.
6/ Estimate water conditions only permitted partial count this day: See field data, Expand by 1.54.
7/ Sampling scheme involved expansion of counts by 1.23. See field data.
8/ On this date hours 20 and 22 only partial count: percentage thus adjusted. See field data.
9/ Calculations and totals subject to rounding error.
10/ Hour counts may not sum to give 18 hour totals. Must be expanded as indicated by computation factor and field data.

Appendix Table 19 . Pink salmon escapement counts, Anvik Tower actual and expanded 1975 1/ (2)

Date	Hours Counted	Actual Total	Expansion Factor 1	Expansion Factor 2	Expanded 24 Hour Total
7-11	18	4		(1.33)	5
7-12	18	23		(1.33)	36
7-13	18	88		(1.33)	117
7-14	19	81	1.26	(1.33)	136
7-15	0	0	7/14+ 7/17÷2		119
7-16	0	0	7/14+ 7/17÷2		119
7-17	10	21	2	(2.4)	101
7-18	10	28	1.54	(2.4)	103
7-19	8	48	1.23	(3)	177
7-20	6.67	37		(3.6)	133
7-21	9	23		(2.7)	62
7-22	9	29		(2.7)	78
7-23	9	21		(2.7)	57
7-24	9	22		(2.7)	59
7-25	9	7		(2.7)	19
7-26	8.5	14		(2.8)	39
7-27	7.5	2		(3.2)	6
Total	162.67	448			1,366

1/ Expanded by: (1) Factor for water and/or other conditions lowering count; (2) Ratio of time counted to 24 hours-Actual hourly counts not believed to be representative during hours of darkness, hence hourly enumeration unusable.

Appendix Table 20. Model calculations and formulas used in analysis.

Expansion of Anvik River tower counts: (1) incomplete daily counts, (2) missing hourly counts, (3) expanded daily counts. 1/

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(1) A = Actual Daily Count
E = Incomplete daily count for 6-24 chum salmon
P = Percent of total count 1/

$$E = \frac{A}{1-P}$$

Example for July 6 expansion for missing hours:

$E = \frac{4,892}{1-0.426}$ or $4,892 \times \frac{1}{.574}$ or $4,892 \times 1.74 = 8,523$

P = Sum of missing percentages

(2) Hourly (example hour one) = 8,523 x 5.4 = 460

(3) Daily total chum salmon 7-6= 18 hour count x expansion factor = 8,523 x 1.19 = 10,145

Mean $\bar{x} = \frac{\Sigma x}{n}$ Variance $S^2 = \frac{\Sigma x^2 - (\Sigma x^2)}{n-1}$ Standard Deviation $S = \sqrt{s^2}$

HO: There is no difference between expected and observed numbers.

Chi Square test: $\chi^2 = \frac{\Sigma(\text{observed} - \text{expected})^2}{\text{expected}}$ df = (rows-1)(columns-1)

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t Test of difference $HO = \bar{m}_1 = \bar{m}_2$

$$t = \frac{(\bar{x}_1 - x_2) - m_1 - m_2}{s\bar{d}} \qquad t = \frac{\bar{x}_1 - \bar{x}_2}{s\bar{d}}$$

$$s\bar{d} = \sqrt{s^2\left(\frac{n_1 + n_2}{n_1 n_2}\right)} \quad \text{pooled} \quad s^2 = \frac{\Sigma x_1 - \frac{(\Sigma x_1)^2}{n_1} + \Sigma x_2^2 - \frac{(\Sigma x_2)^2}{n_2}}{(n_1 - 1) + (n_2 - 1)}$$

Where n_1 or n_2 are greater than 30: $df = (n_1 - 1) + (n_2 - 1)$

$$s\bar{d} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Where n_1 or n_2 is less than 30:

$$t_s = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, S_2^2}{n_1 + n_2 - 2}\left(\frac{n_1 + n_2}{n_1 n_2}\right)}}$$

F test $F = \frac{\text{the larger } S^2}{\text{the smaller } S^2}$

1/ See text page and Appendix Table 18 for further explanation and base data. Formulas for statistical tests presented by Sakall (1973).

Appendix Table 21. Anvik River tower chum salmon cumulative inmigration percentage by date (expanded count) for years 1973-1975.

Date	1975	1974	1973
6-23			
24		0.6	
25		1.4	
26		2.8	
27		4.1	0.1
28		5.5	
29		7.6	0.9
30		10.4	2.5
7-1		14.0	5.7
2		18.1	11.0
3		23.5	19.1
4		30.9	26.1
5		37.2	31.7
6	1.7	44.1	36.5
7	4.5	49.5	38.8
8	7.6	54.2	42.8
9	15.0	58.9	50.8
10	23.4	65.6	58.4
11	29.3	69.2	69.1
12	37.7	73.4	75.4
13	46.8	79.3	80.4
14	58.1	87.0	84.4
15	66.9	94.1	87.6
16	75.7	96.4	89.4
17	81.9	97.6	92.2
18	86.9	99.4	94.3
19	90.2	100.0	95.5
20	93.0		96.3
21	95.3		97.2
22	96.7		98.0
23	97.8		98.3
24	98.8		98.6
25	99.3		98.9
26	99.7		99.0
27	100.0		100.0

Appendix Table 22. Anvik River carcass counts, July 25 through August, 1975.

Sample Location	Estimated Distance Surveyed (yds.)	Chum Male	Chum Female	Chum Undet.	Chum Total	King	Pink	Total
ABOVE TOWER								
1/8 mi. above Swift River-east bank	200	167	214	14	395	0	0	395
Mouth Swift River west	200	701	593	43	1,337	0	0	1,337
1/4 mi. below Swift River-west	200	133	179	62	374	0	2	376
Runkels Creek-midriver	100	116	119	0	235	2	0	237
1.5 mi. above Runkels-midriver	400	253	310	253	816	0	0	816
1.5 mi. above Runkels-east	200	753	558	78	1,389	0	0	1,389
1/2 mi. above Runkels-east	200	318	355	27	700	0	1	701
Mouth Runkels-west	200	234	278	144	656	0	2	658
1/2 mi. above Tower-west	100	165	145	61	371	0	0	371
1/4 mi. above Tower-west	200	657	756	295	1,708	0	0	1,708
Sub-Total (upstream)	2,000	3,497	3,507	977	7,981	2	5	7,988
BELOW TOWER								
1 mi. below Tower-west bank	100	149	206	42	397	0	0	397
1/2 mi. below Yoder's Cabin-midriver west	100	94	176	19	289	0	2	291
1.5 mi. above Beaver Creek-east	200	173	139	161	473	0	0	473
2 mi. above Yellow River-west	200	696	703	377	1,776	0	1	1,777
1/4 mi. above Beaver Creek-east	200	259	245	96	600	0	2	602
1/8 mi. above Beaver Creek-east	200	201	264	202	667	2	0	669
2.5 mi. above LaVoie's Cabin-east	200	111	135	103	349	0	1	350
2 1/4 mi. above LaVoie's Cabin-west	200	98	92	149	339	0	0	339
Fishnet slough-west	200	990	896	520	2,406	0	0	2,406
1/2 mi. below Fishnet slough-west	200	211	216	96	523	0	2	525
1/2 mi. above LaVoie's Cabin-west	200	219	162	125	506	0	0	506
Sub-Total (downstream)	2,000	3,201	3,234	1,890	8,325	2	8	8,335
Grand Total	4,000	6,698	6,741	2,867	16,306	4	13	16,323

Percentages for chum 1/2/

	Male	Female	Sub-Total	Unidentified
Number	6,698	6,741	13,439	2,867
Percent	49.84	50.16	82.42	17.58

1/ Based on sub-totals known-13,439
2/ Based on total-16,306.

Appendix Table 23. Chi-square analysis of sex composition of various population segments 1/.

Sample Group	Actual no. males	Actual no. females	No. expected each sex	Total	X^2
Anvik River chum scale samples	271	313	292	584	3.32NS
Anvik chum beach surveys	6,698	6,720	6,709	13,418	0.02NS
Sheenjek chum	81	122	101.5	203	8.28**
Delta chum	152	137	144.5	289	0.78NS
Yukon kings 75	988	834	911	1,822	13.00**
Yukon kings 74	780	567	673.5	1,347	33.68**
Yukon chums 74	856	713	784.5	1,569	13.0**

1/ Expected number males and females assumed to be equal: df=1.

** Highly significant difference at .01 level.

Appendix Table 24. Chum salmon length comparisons.

Category		(n) No. Fish	$\bar{x}$ 1/ Ave. Length	s^2 Variance	Range		df	t
Anvik River	Chum 4_1M 75	254	573.27	898.80	510	660		
"	Chum 4_1F 75	288	534.71	495.51	475	635	540	16.84**
"	Chum 3_1M	4	575.75	1,739.67	550	640		
"	Chum 3_1F	17	529.65	312.13	495	560		
"	Chum 5_1M	13	596.75	1,817.58	519	640		
"	Chum 5_1F	9	547.00	646.00	518	580	20	3.08**
"	Chum 3_1	21	539.00	901.00	495	640		
"	Chum 4_1	542	552.77	1,054.28	475	660		
"	Chum 4_1	542	552.77	1,054.28	475	660		
"	Chum 5_1	22	576.17	2,004.76	518	640		
"	Chum 3_1	21	539.00	901.00	495	640		
"	Chum 5_1	22	576.17	2,004.76	518	640	41	1.20NS
"	Chum M	271	574.44	965.97	510	660		
"	Chum F	313	534.33	587.58	475	635	582	17.1**
"	Chum 4_1 75	542	552.77	1,054.28	475	660		
"	Chum 3_1 and 5_1 75	43	557.95	1,673.45	495	640	583	0.82NS
Anvik	Chum pooled 75	584	552.95	1,178.46	475	660		
Sheenjek	Chum pooled 75	196	590.09	1,219.2	504	682	778	12.89**
Sheenjek 75	Chum M 75	81	599.94	1,207.6	504	682		
Sheenjek 75	Chum F 75	115	583.15	1,120.6	518	672	194	3.41**
Sheenjek	Fish Slough 75	145	589.15	1,153.28	513	672		
"	Russells Cabin 75	49	586.96	1,168.27	504	682	192	0.39NS
Sheenjek 75		196	590.09	1,219.2	504	682	195	
Manley 75		410	582.81	1,028.48			604	2.46*
Sheenjek 75		196	590.09	1,219.2	504	582	195	
Neanna 75		951	595.40	1,077.15	464	698	1,145	1.96
Sheenjek 75		196	590.09	1,219.2	504	682		
Sheenjek 74		139	561.69	2,187.43	481	708	333	6.09**
Anvik 75		584	552.95	1,178.46	475	660	583	
Anvik 74		442	564.98	1,681.82	479	663	441	5.01**
Sheenjek 74		139	561.69	2,187.43	481	708	138	
Anvik 74		442	564.78	1,681.82	480	640	441	0.75NS
Anvik 73		886	551.59	1,402.43	460	735	885	
Anvik 75		584	552.95	1,178.46	475	660	584	0.72NS
Emmonak 75 Summer 5½" GN 2/ 7/4 - 7/15		420	568.95	735.49			419	
Emmonak 75 Summer 8½" GN 2/ 7/4 - 7/13		332	584.25	1,019.52			331	6.81**
Emmonak 75 7/4 - 7/15 Summer		752	575.62	918.82			751	
Emmonak 75 7/16 - 8/8 Fall		712	589.52	827.71			711	9.09**
Emmonak Summer 75		752	575.62	918.82			751	
Anvik 75		584	552.95	1,178.46			583	12.54**
Emmonak 75 Summer 5½" GN		420	568.95	735.49			419	
Anvik		584	552.95	1,178.46				8.2**
Emmonak 75 pooled		1,464	582.38	922.25			1,493	
Emmonak 74 pooled		1,426	576.83	1,216.44			1,425	4.55**
Emmonak 75 Summer pooled		752	575.62	918.82			751	
Emmonak 74 Summer pooled		968	577.44	1,184.16			976	1.53NS
Emmonak 75 Fall		712	589.52	827.71			711	
Emmonak 74 Fall		458	575.52	1,284.51			457	6.66**
Emmonak Fall 75		712	589.52	827.71			711	
Sheenjek Fall 75		196	590.09	1,219.20			195	0.16NS
Anvik 75		584	552.95	1,178.46			583	
Salcha 75		306	563.59	875.57			305	4.84**
Sheenjek 75		196	590.09	1,219.20	504	682	195	
Delta 75		289	591.05	1,095.61			288	0.32NS
Emmonak Summer 75		752	575.62	918.82			751	5.99**
Salcha 75		306	563.59	875.57			305	
Chena		37	568.94	1,053	500	620	36	

1/ Length in mm; tip of snout to fork of tail.
* Significant difference at 5% level.
** Highly significant at 1% level.

2/ Chums taken at Emmonak 7/15 and earlier considered summer; and later considered Fall.

ppendix Table 25. Size composition of fishwheel king salmon catches compared to size composition of all other king salmon sampled. 1/ 2/

Size Category

	Under 50 cm observed	Under 50 cm expected	50-60 cm O	50-60 cm E	60-80 cm O	60-80 cm E	Over 80 cm O	Over 80 cm E	Total O
Combined ishwheel atches	17	5	175	63	210	156	121	293	523

Chi Square value 347, highly significant with 3df.

1/ Expected values based on percent in each category found for all other king salmon sampled: Under 500, .01; 501-600, 12; 601-800, 30; over 800, 56. Total of 1,682 fish.

2/ Fishwheel samples from Nenana, Galena and Dawson City.

Appendix Table 26 . Summary of Yukon River salmon tagging projects.

				Tagging					Recovery					
Author	Year	Study Period	Species	No.	Method	Location	No.	%	Method	Location	Rate Movement	Population Estimate	Tag Type	Comments
Geiger	68	68	king	376	gillnet	Flat Island		29.6	ADFG crew			83,600	Yellow Spaghetti Tag	
			chum	591	"	"		7.6	CF, GN		29.6mi/day		"	
Lebida	71	70	summer chum	3,000	GN, FW	above Andreafsky	129		FW, GN	River mi 251	12.8mi/day	3,176,000	Floy and Spaghetti	
			king		GN,FW	"			FW, GN	below Anvik	23.9mi/day	226,740	"	
Lebida	69	69	king	293		above Andreafsky		26.3	CF	CF	24.2mi/day	160,564	Floy and Spaghetti	
			chum	1,506				6.9			22mi/day		"	
Lebida	72	71	summer chum	6,383	GN, FW		131	2.1	CF		11.0mi/day			
			fall chum	485	GN, FW		17	3.5	GN, FW		21.1mi/day			
Hayes	61	61	chum	9,768		Texas Creek	3,705		CF, Crew	6Mi. Island			1" Peterson Disk Tag	selectivity for tag type by gillnet found
Regnart	63	61	fall chum	1,097	FW	River Mi. 87	322	31.9					"	
		62	chum	3,967									"	
Regnart	64	63	king	453	GN	Flat Island		30.7			14mi/day		Spaghetti	
		63	king	142	FW	Pilot St.		49.2			20mi/day		"	
		64	King	175	FW	Flat Island		33.1			16mi/day		"	
Regnart	65	64	chum	Study of migration as indicated by peak catches tower to river.							25-32mi/day			
		65									31mi/day			
Trasky	73	70	chum	3,049	FW, GN	River mi.85 Ohogamint		4.2	ADFG crew	River mi 251	11.2mi/day	above site 3,133,628	Floy	
												3,629,594	Spaghetti	
		70	king	340	FW, GN	"		14.4	"	"		146,041	above site	Spaghetti
		71	chum	6,153		Mile 185		2.1				226,740	below site	"
		71	fall chum	420								1,560,157	below site	
											21.1mi/day	1,047,080	above site	
U.S.F.W.S.	64	61	chum									131,000	above dam site	
			king									17,000	above dam site	
			coho									50,000		